

한국 성인에서 표재성 요골신경의 해부학적 변이

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Anomalous Superficial Radial Nerve Innervation to the Ulnar Dorsum of the Hand in Korean Adults

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Objective: The purpose of this study is to clarify the incidence of anomalous superficial radial innervation to the ulnar dorsum of the hand and anomalous innervation of the dorsal ulnar cutaneous nerve to the radial dorsum of the hand in Korean adults.

Method: Nerve conduction studies were performed on 230 hands of 115 persons to identify anomalous innervations. Sensory nerve action potentials were recorded simultaneously using a 2-channel technique on both hands.

Results: Anomalous innervation of the superficial radial nerve to the ulnar dorsum of the hand was observed in only 2 of the 230 hands of 115 persons, showing an incidence of 0.86%. Anomalous innervation of the dorsal ulnar cutaneous nerve to the radial dorsum of the hand was not found in any subject.

Conclusion: This is the first study to report the incidence of anomalous superficial radial innervation to the ulnar dorsum of the hand in an Asian population. We found that the incidence of anomalous superficial radial innervation to the ulnar dorsum of the hand in Korean people was lower than that found in Western populations.

Key Words: anomalous innervation, superficial radial nerve

Introduction

Anatomical variation is not a rare finding in the

peripheral nervous system.^{1,2} Being asymptomatic in nature, most variations remain undiscovered in life, yet these variations cause unexpected results in electrophysiological studies. Among electrophysiological studies, nerve conduction studies (NCSs) of distal nerves are broadly used as a standard tool for screening and early diagnosis of peripheral neuropathy. Because anatomical variations may be confusing the interpretation of NCS results in diagnosing neuromuscular disease, accurate knowledge about anomalous patterns

Received May 18, 2016

Revised (1st) June 11, 2016, (2nd) July 2, 2016

Accepted July 4, 2016

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of peripheral nerve innervations is important.³

Anatomical variations in the peripheral nervous system are most commonly found in the median nerve, the ulnar nerve, and the fibular nerve.^{1,2} The incidence of these anomalies and their clinical significance, such as the Martin-Gruber anastomosis between the median and ulnar nerves and the accessory branch of the fibular nerve, has already been reported.⁴ Less frequently reported, dorsal ulnar cutaneous nerve conduction studies occasionally show reduced or even no response without any associated symptoms or signs. Jabre introduced a nerve conduction technique for recording from the dorsal ulnar cutaneous nerve.⁵ He found that 11% of the 30 asymptomatic volunteers had an asymmetric response from the dorsal ulnar cutaneous nerve, with a difference of 50% or more in amplitude between the two arms. He suggested that the reason for the asymmetry was unrecognized injury. However, Mok et al. dissected 30 cadaver forearms and found a case where the ulnar dorsal cutaneous nerve was absent and the dorsal hand was innervated by the superficial radial nerve.⁶ Leis et al. reported that 16 of 100 subjects had an absent or markedly reduced ulnar dorsal cutaneous response and anomalous superficial radial innervation to the ulnar dorsum

of the hand,⁷ which could explain the asymmetric electrophysiological responses observed by Jabre. Thus, radial-to-ulnar anomalous innervation should be carefully considered in patients who are suspected to have ulnar neuropathy and need electrophysiological confirmation on the level of injury.

Although several studies have reported anomalous innervation of the superficial radial nerve,^{3,7-9} no study has been performed in an Asian population. The purpose of this study is to clarify the incidence of anomalous superficial radial innervation to the ulnar dorsum of the hand in Korean adults.

Materials and Methods

1) Subjects

A total of 115 volunteers (42 males and 73 females) were included in this study. The participants had no past clinical history of neuropathy symptoms, such as sensory deficit, tingling sensation in the upper limbs, or motor weakness; no previous diagnosis of diseases that can cause peripheral neuropathy, such as diabetes mellitus, chronic alcohol intake, or nephropathy; and no history of trauma to the upper extremities.

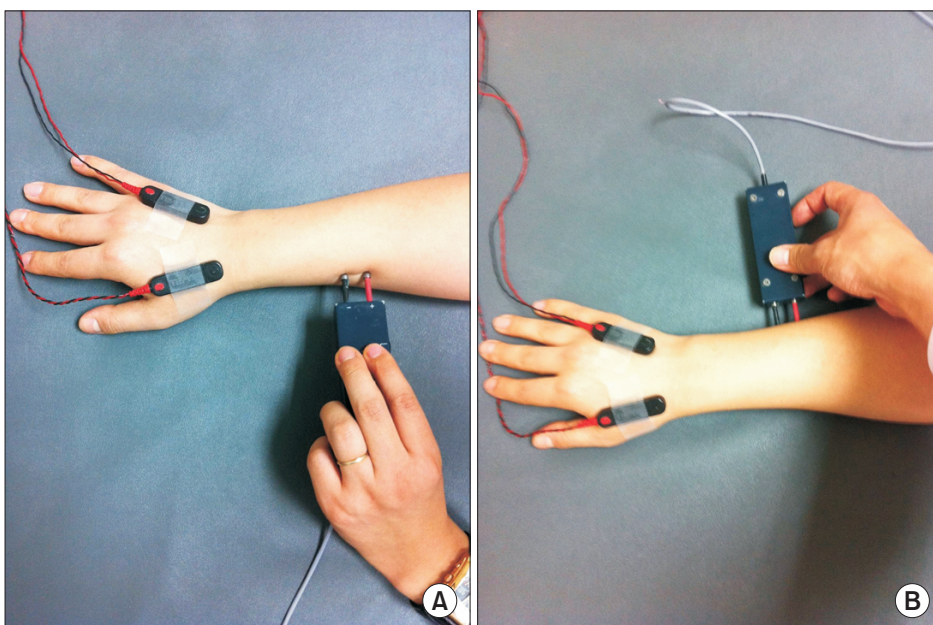


Fig. 1. The method of nerve conduction studies. Superficial radial nerve stimulation was performed 7 cm above the radial styloid process on the dorsolateral aspect of the radius (A). The dorsal ulnar cutaneous nerve was stimulated 5 cm above the ulnar styloid between the flexor carpi ulnaris tendon and the ulna (B). SNAPs were recorded simultaneously using a 2-channel technique. The recording electrodes were placed at the main portion of the nerve over an extended extensor pollicis longus tendon for the superficial radial nerve and at the apex of the "V" space between the fourth and fifth metacarpal bones for the dorsal ulnar cutaneous nerve.

2) Methods

Sensory nerve action potentials (SNAPs) were recorded simultaneously using a 2-channel technique with two surface active electrodes and two reference electrodes on both hands of each participant (Fig. 1). For the dorsal ulnar cutaneous nerve, the active recording electrode was placed at the apex of the “V” space between the fourth and fifth metacarpal bones. The reference electrode was placed distally, at the base of the fifth digit.¹⁰ For the superficial radial nerve, the active recording electrode was placed over the main portion of the nerve, which was palpated over the extensor pollicis longus tendon. The reference electrode was placed 3 cm distal to this location, approximately midway between the first and second metacarpophalangeal joints.¹⁰ The ground electrode was placed over the dorsum of the hand. The room temperature was maintained between 23 and 25°C. The superficial radial nerve was stimulated 7 cm above

the radial styloid process on the dorsolateral aspect of the radius. The dorsal ulnar cutaneous nerve was stimulated 5 cm above the ulnar styloid between the flexor carpi ulnaris tendon and the ulna (Fig. 1). We repeated the same procedure on both arms of each subject.

Results

The age of subjects ranged from 18 to 81 years (mean \pm standard deviation, 49.9 ± 14.4 ; male : female = 43 : 72) (Table 1). Anomalous superficial radial innervation to the ulnar dorsum of the hand was found in two (1.73%) of 115 subjects and in two (0.86%) of 230 hands (Fig. 2). The anatomical variations were unilateral. Anomalous dorsal ulnar innervation to the radial dorsum of the hand was not found in any subject.

Normal values for the superficial radial nerve and the dorsal ulnar cutaneous nerve derived from the remaining 113 subjects are shown in Table 2. The onset latency and the amplitude of superficial radial nerve SNAPs were 1.5 ± 0.4 ms and 36.2 ± 12.7 μ V, respectively. The onset latency and the amplitude of dorsal ulnar cutaneous nerve SNAPs were 1.3 ± 0.3 ms and 34.5 ± 13.3 μ V, respectively.

Table 1. Demographic Data for Age and Gender Distribution of Subjects

Age (years)	Male (n)	Female (n)
11~20	2	1
21~30	4	6
31~40	7	9
41~50	5	15
51~60	14	27
61~70	9	12
71~80	1	2
81~90	0	1
Total	42	73

Discussion

In this study, we aimed to elucidate the incidence

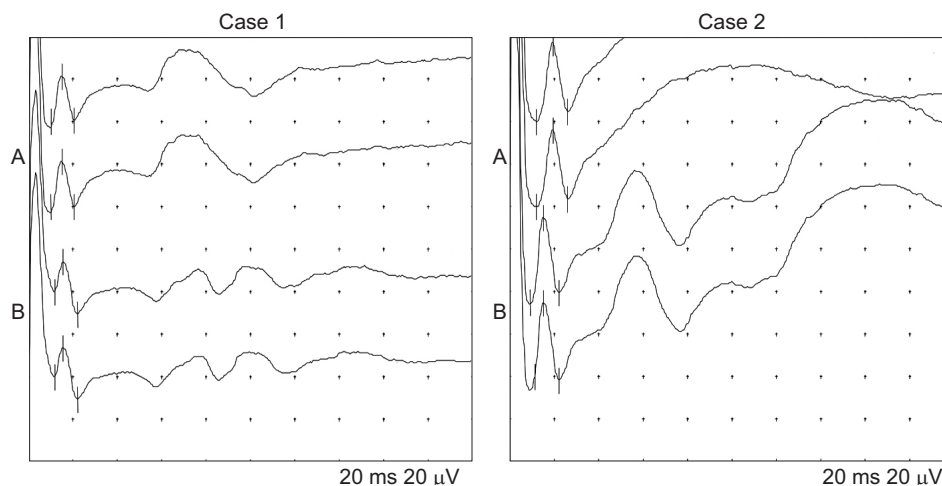


Fig. 2. Two cases of anomalous superficial radial innervation to the ulnar dorsum of the hand. Case 1 is a male (65 years old), and case 2 is a female (51 years old). In these two cases, when the superficial radial nerve was stimulated 7 cm above the radial styloid process, SNAPs were recorded simultaneously both over the extensor pollicis longus tendon for the superficial radial nerve (A) and at the apex of the “V” zone between the fourth and fifth metacarpal bones for the dorsal ulnar cutaneous nerve (B).

Table 2. Nerve Conduction Studies of the Superficial Radial Nerves and the Dorsal Ulnar Cutaneous Nerves

	Superficial radial nerve		Dorsal ulnar cutaneous nerve	
	This study	Cappellari A. et al. ¹³	This study	Leis A. et al. ⁷
Latency (ms)	1.5 ± 0.4	1.6 ± 0.1	1.3 ± 0.3	1.3 ± 0.3
Amplitude (μV)	36.2 ± 12.7	43.7 ± 11.1	34.5 ± 13.3	32.2 ± 12.8

of anomalous superficial radial innervation to the ulnar dorsum of the hand in Korean adults. And we found that only 1.7% of subjects had this anomalous innervation, and it happened only unilaterally.

Previous electrodiagnostic studies have reported varying occurrence rates of anomalous superficial radial innervation to the ulnar dorsum of the hand, ranging from 0 to 16%.^{7,8,11} Spindler and Felsenthal reported a dorsal ulnar cutaneous response in all 30 subjects and no anomalous superficial radial innervation to the ulnar dorsum.⁸ They regarded a response of 5 μV as normal, although such a low value was considered abnormal in other published studies.^{5,12} Also, this report focused on radial sensory distribution, not on the dorsal ulnar cutaneous nerve. By contrast, Leis et al. found 16% subjects with anomalous superficial innervation to the dorsum of the hand, unilaterally in 14%.

The anomalous innervation of superficial radial nerve was uncommon and happened only unilaterally in this study. We suggest that the discrepancy between our results and those of several previous studies is caused by racial difference. Kuruvilla et al. reported that a patient with bilateral anomalous superficial radial innervation to the ulnar dorsum had a child who had a similar anomaly and suggested the possibility of an autosomal dominant pattern of inheritance.⁹ In any event, none of the 115 Korean adult subjects in this study had bilateral anomalous innervations.

If a clinician does not consider this anomalous innervation, the level or severity of ulnar neuropathy may be misdiagnosed. If the clinician does not assure clinically intact sensation of the dorsum of the hand, he may misdiagnose ulnar neuropathy at the elbow level on finding an absent dorsal ulnar cutaneous response. Without electrophysiologic study, the clinician can

misinterpret preserved sensation on the ulnar side of the dorsum of the hand as a presumptive sign of ulnar neuropathy at the wrist level.⁷ Although the anomalous superficial radial innervation to the ulnar dorsum of the hand is rare in Korean people, we recommend that clinicians stimulate the superficial radial nerve to evaluate for anomalous superficial radial innervation to the dorsum of the hand in cases of incongruent findings between electrodiagnostic and clinical examinations for diagnosing ulnar neuropathy.

Conclusion

To our knowledge, this is the first study to report the incidence of anomalous superficial radial innervation to the ulnar dorsum of the hand in an Asian population. We found the incidence in Korean people was lower than that reported for Western populations.

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