

The usefulness of High-Resolution Ultrasonography for Diagnosing Unilateral Cervical Radiculopathy

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Introduction

Cervical radiculopathy (CR) is a pathologic process caused by compression or inflammation of the cervical nerve root and is usually diagnosed by a combination of clinical examination and additional studies including magnetic resonance imaging (MRI) or electrodiagnostic test (EDX). Ultrasonography (US) is more suitable for screening than other studies by providing a high-resolution image that can be obtained quickly and easily in any environment. These characteristics of US can be applied to the diagnosis of CR. The aim of this study was to investigate the usefulness of high-resolution US to make a diagnosis of unilateral CR by comparing the cross-sectional area (CSA) of affected and unaffected sides of cervical NR.

Methods

Total 17 CR patients and 13 healthy volunteers were enrolled in this study. The CR patients must meet all the following conditions: (1) symptoms of unilateral CR (2) diagnosis of unilateral CR (C6 or C7) by EDX, (3) cervical disc herniation or cervical degenerative spondylosis confirmed by MRI. The exclusion criteria were as follows: (1) myelopathy, (2) neck pain only, (3) diabetes or other metabolic dysfunction inducing polyneuropathy (4) multilevel CR, (5) history of surgical intervention. Controls were healthy volunteers without symptoms of CR, history of cervical trauma, diabetes, and other metabolic dysfunction. The cervical nerve roots were imaged at the most proximal location possible by US, where they exited over the transverse process. The CSAs of cervical nerve roots were measured using continuous trace tool of US device, tracing just inside the hyperechoic border of each nerve roots (Fig. 1). In the CR patients, the CSAs of affected and unaffected sides were measured at the level of CR. In the control group, the CSAs of bilateral C6 and C7 nerve roots were measured. We conducted a Wilcoxon signed-rank test for comparing the CSAs between affected and unaffected side of C6 and C7 nerve roots in the CR patients. Side to side differences of CSA in cervical nerve roots (Δ CSA) were calculated in the CR patients and control group, and then a Mann-Whitney U test was used for comparing Δ CSA between the CR patient and control group.

Results

The baseline characteristics of the study participants are shown in Table 1. In the C7 CR patient, the CSAs of affected nerve roots were significantly larger than those of unaffected nerve roots (C6: $p=0.144$, C7: $P=0.013$, Table 2). In the C6 and C7 CR patients, Δ CSAs were significantly larger than those of the control group (C6: $P=0.048$, C7: $P=0.008$, Table 2).

Conclusion

This study revealed that the CSA of the affected nerve root was enlarged than the unaffected nerve root in CR patient, and Δ CSA in the CR patient was greater than in the control group. We recommend measurement of the CSAs of affected and unaffected nerve root at the same cervical level for increasing the diagnostic accuracy of CR and making the diagnosis of CR easily and rapidly.

Table 1. Baseline characteristics of the CR group and the control group

	CR patient		Control
	C6	C7	
Total (n)	5	12	13
Side [Rt(%) / Lt(%)]	1 (20%) / 4 (80%)	6 (50%) / 6 (50%)	-
Gender [n(%)]			
Male	3 (60%)	9 (82%)	8 (67%)
Female	2 (40%)	3 (18%)	4 (33%)
Age	57.4 \pm 5.2	60.5 \pm 10.5	44.6 \pm 10.3
Body mass index	26 \pm 5	27 \pm 4	26 \pm 3

CR Cervical radiculopathy, Rt right, Lt left
Values are mean \pm SD.

Table 2. CSA and of cervical NRs in the CR group and the control group

	CSA (mm ²)	
	C6 NR	C7 NR
Control	10.64 \pm 1.36	10.79 \pm 1.35
Unaffected side	11.80 \pm 1.64	11.58 \pm 2.44
Affected side	14.54 \pm 1.67	14.31 \pm 1.80
P-value (Affected vs. Unaffected)	0.144	0.013*

	Δ CSA (mm ²)	
	C6 NR	C7 NR
Control	1.31 \pm 0.95	1.13 \pm 0.83
CR patient	3.58 \pm 1.53	3.75 \pm 1.35
P-value (CR patient vs. Control)	0.013*	< 0.001*

CSA cross-sectional area, Δ CSA side to side difference of bilateral CSA, NR nerve root
Values are mean \pm SD. * Statistically significant.

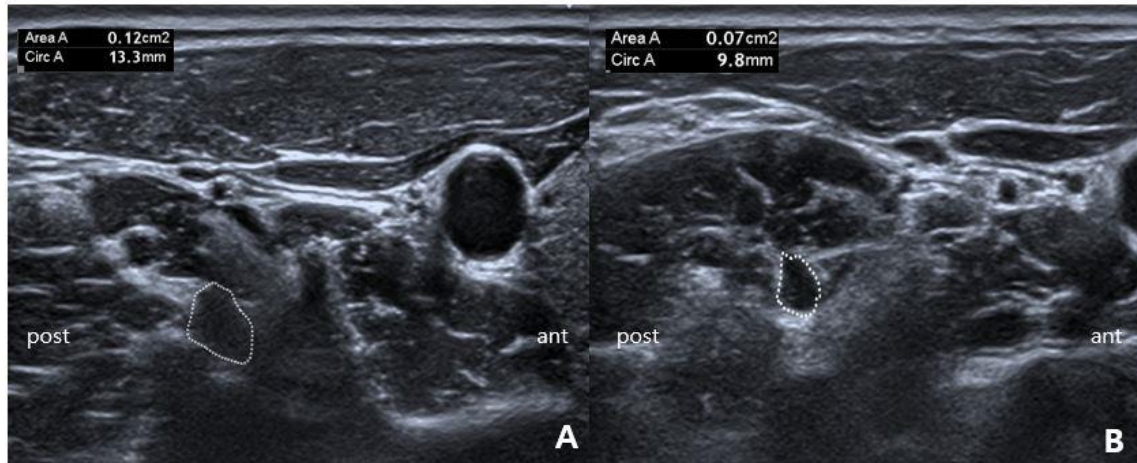


Fig. 1. Transverse scan of C6 nerve root (dotted line) in a patient diagnosed as left C6 CR. The CSAs of the affected (A) and unaffected (B) sides were measured with trace tool at most proximal location, which can be detectable in ultrasonography. NR nerve root, CR cervical radiculopathy, CSA cross-sectional area, ant anterior, post posterior