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## MR Imaging of Carpal Tunnel Syndrome : The Usefulness of MRI in Treatment Decisions

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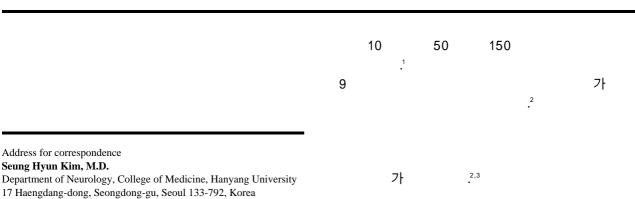
**Backgrounds**: Carpal tunnel syndrome (CTS) is a common condition that is usually diagnosed by electrophysiologic studies. However, CTS provide limited information to determine the causes of CTS and to choose the treatment method. We evaluated diagnostic sensitivity of MR imaging and treatment decisions by MR imaging in electrodiagnosed CTS.

**Methods**: 14 patients (26 wrists) with electrodiagnosed CTS were studied using MR imaging. In 26 wrists for which axial T1 & T2 weighted images were obtained at 1.5T with a decided wrist coil. Previously described MR imaging of CTS such as increased median nerve signal, flattening of median nerve, reticular bowing, tenosynovitis and space occupying lesions were retrospectively evaluated. Degree of improvement was evaluated by global symptom score (GSS). The GSS rated symptoms from 0 (no symptoms) to 10 (severe) in each of five categories: pain, numbness, paresthesia, weakness/clumsiness, and nocturnal awakening. Subjects' GSS was recorded at baseline, 2 weeks, 1 month, 6 months after treatment. We decided to medical treatment that showed mainly inflammatory sign such as increased median nerve signal, tenosinovitis and to surgical treatment such as space occupying lesion, high canal pressure sign.

**Results**: MR imaging showed that increased median nerve signal were in 20 wrists (77%), flattening of median nerve were in 6 wrists (23%), reticular bowing were in 3 wrists (12%), tenosynovitis were in 8 wrists (32%), decreased canal size in 2 wrists (7.6%), space occupying lesion were in 1 wrist (4%). A good outcome was revealed in 21 wrists by medical treatment that showed mainly increased median nerve signal, tenosynovitis. The mean GSS were 27.7 at baseline, 11.2 at 2 weeks, 11.0 at 6 months in medical treatment group. Another 5 wrist had surgical treatment shown by ganglion and high canal pressure sign such as median nerve flattening, reticular bowing, decreased canal size: 3 wrists had good prognosis, but 2 wrists (one patient) had no significant improvement due to small carpal tunnel size.

**Conclusions**: Our results are in agreement with most previously described MR imaging signs of CTS. MR imaging plays an important role in several cases and especially in the assessment of failure of surgical treatment. Knowledge of MR findings may permit more rational choice of treatment.

Key Words: Carpal tunnel syndrome, MR imaging, Treatment methods



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가 가 가 가, 가 )~10 5가 가 2001 11 2002 4 가 , 50 , 2 , 1 , 6 symptom score, GSS)<sup>5</sup> (Neuropack 8, Nihon Kohden, Tokyo, 26 Japan) 2 - (II-W), 3 -(III - W), - (P-W), III-P 14 (26) 3, 11 41.26 m/sec 47 (28~60) 가 2 , 34.05 m/sec , III-P/P-W 가 12 . GSS 28.6 (24~36) 2 , 1 , 10 (Table 1). 1. (1.5T, CVI, GE, Milwaukee, U.S.A.) 26 20 (77%) T2 (Fig. 1), 8 (30%) axial 2 mm T1 (TR; 500, TE; 22 msec) T2 (TR; 4000, TE; 89.5 msec) (Fig. 2). 가 가 가 6 (23%) 3 (12%) (Fig. 3). T2 1

**Figure 1.** Axial T1-weighted (**A**) and T2-weighted (**B**) image. Wrist MR image shows hyperintense and swollen median nerve (arrow).

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, 0.8×0.6×1.3 cm (case 1, Fig. 4).

2.
26 21
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GSS 27.7 2 11.2 , 1 11.6 , 6 11.0

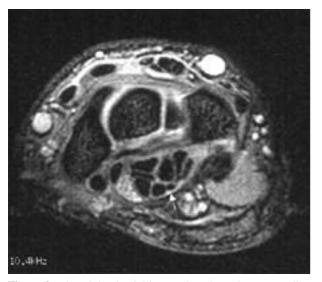
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 $205.9\ mm^2$  (Table 1).

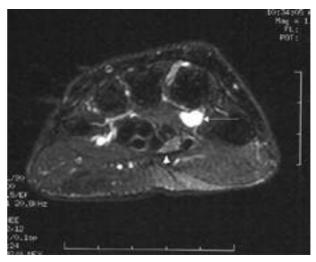
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.9 T1 , T2 , T2

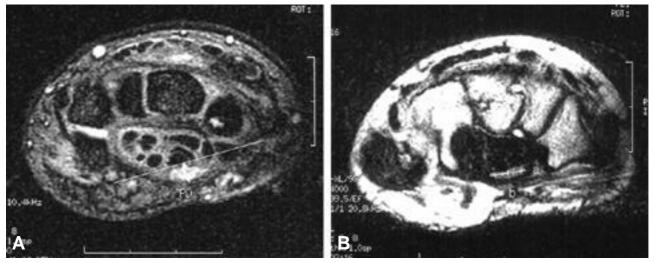
> .º° 80~95%



**Figure 2.** T2-weighted axial image show hyperintense median nerve and tenosynovitis (arrow)



**Figure 4.** MR image shows median nerve (short arrow) and ganglion cyst (long arrow).

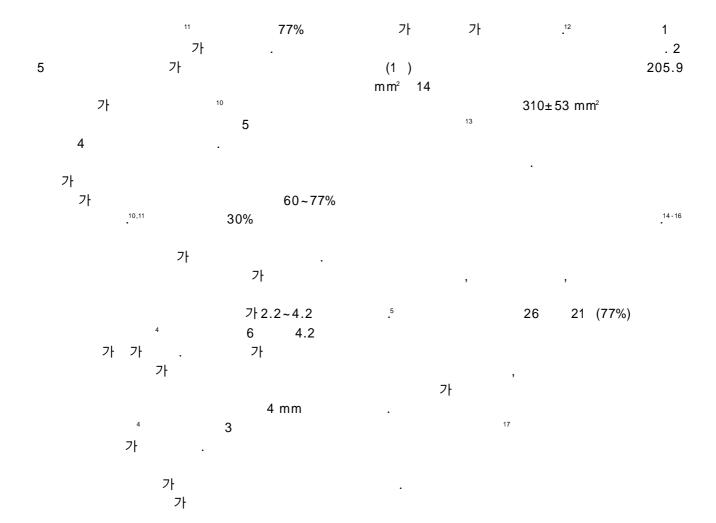


**Figure 3. A.** T2-weighted axial image shows bowing and palmar displacement (PD) of the flexor retinaculum (arrow). **B.** T2-weithted image shows flattening of the median nerve (a/b ratio is above 4.2).

Table 1. Patients' information

No.	Sex/Age	Risk factor	involved	Global symptom score			2	MD C 1' *	
		occupation	wrist	baseline	2 wks	1 month	6 months	MR findings*	Treatment
1	F/55	house wife	both	31	10	9	9	Rt: T2H, ganglion, F, B.	operation
								Lt: T2H, T.	on right wrist
2	M/35	white color	Left	24	9	10	9	Rt: T2H, T.	steroid injection
3	F/54	house wife	Right	27	11	12	10	Rt : T2H.	steroid injection
4	F/45	house wife	both	36	24	22	23	Both: no significant findings.	oral steroid
5	F/53	house wife	both	23	11	11	11	Both: T2H.	NSAIDs
6	F/57	DM	both	32	11	12	15	Both: no significant findings.	steroid injection
7	F/48	RA	both	31	30	28	28	Both: small canal size,	operation
								F.	on both wrists
8	F/45	hypothyroidisn	n both	26	16	15	15	Rt: No significant finding.	NSAIDs
								Lt : T2H, T.	
9	M/52	trauma	both	24	5	5	4	Rt: T2H, T.	steroid injection
								Lt : T2H, T.	
10	F/34	DM	both	30	24	18	15	Both: T2H.	NSAIDs
11	F/40	house wife	both	34	10	10	8	Both: T2H, F, B.	operation
									on both wrists
12	F/60	house wife	both	30	9	9	8	Rt : T2H.	steroid injection
								Lt: F.	
13	F/46	house wife	both	25	7	7	6	Both: T2H.	steroid injection
14	M/28	programmer	both	28	7	6	6	Both: T2H, T.	steroid injection

<sup>\*</sup> T2H: median nerve high signal in T2 weighted image, F: Flattening of median nerve, B: reticular bowing. T: tenosynovitis.



## REFERENCES

- Cheadle A, Franklin G, Wolfhagen C, et al. Factors influencing the duration of work-related disability: A population-based study of Washington State workers' compensation. *Am J Public Health* 1994;84:190.
- Mesgarzadeh M, Schenck CD, Bonakdarpour A. Carpal tunnel. MR imaging part I. Normal anatomy. *Radiology* 1989:171:743-748.
- Mesgarzadeh M, Schenck CD, Bonakdarpour A, Mitra A, Conaway D. Carpal tunnel. MR imaging part II. Carpal tunnel syndrome. *Radiology* 1989;171:749-754.
- 4. Buchberger W. Radiologic imaging of the carpal tunnel. *European J Radiol* 1997;25:112-117.
- Herskovitz S, Berger AR, Lipton RB. Low-dose, short-term oral prednisone in the treatment of carpal tunnel syndrome. *Neurology* 1995;45:1923-1925.
- 6. Simpson JA. Electrical signs in the diagnosis of carpal tunnel and related symptom. *J Neurol Neurosurg Psychiatry*. 1956:19:275-280.
- Weiss KL, Beltran J, Sharman OM, et al. High-field MR surface-coil imaging of the hand and wrist. *Radiology* 1986;160:143-146.
- 8. Middleton WD, Kneeland JA, Kellman GM, et al. MR imaging of the carpal tunnel: Normal anatomy and prelim-

- inary findings in the carpal tunnel syndrome. *AJR* 1987; 148:307-316.
- 9. Horch RE, Allmann KH, Langer M, Stark GB. Median nerve compression can be detected by MR imaging of the carpal tunnel. *Neurosurgery* 1997;41:76-82.
- Jarvik JG, Yeun E. Diagnosis of carpal tunnel syndrome: electrodiagnositic and magnetic resonance imaging evaluation. *Neurosurg Clin N Am* 2001;12:241-253.
- 11. Jarvik JG, Yeun E, Haynor DR, et al. MR nerve imaging in a prospective cohort of patients with suspected carpal tunnel syndrome. *Neurology* 2002;58:1597-1602.
- 12. Kerrigan JJ, Bertoni JM, Jaeger SH. Ganglion cyst and carpal tunnel syndrome. *J Hand Surg* 1988;13:763-765.
- 13. Monagle K, Dai G, Chu A, Burnham RS, Snyder RE. Quantitative MR imaging of carpal tunnel syndrome. *AJR* 1999; 172:1581-1586.
- Quality Standards Subcommittee of the American Academy of Neurology. Practice parameter for carpal tunnel syndrome (summary statement). *Neurology* 1993;43:2406-2409.
- American Academy of Neurology, American Association of Electrodiagnostic Medicine and Rehabilitation. Practice parameter for electrodiagnostic studies in carpal tunnel syndrome (summary statement). *Neurology* 1993;43:2404-2405.
- 16. Olney RK. Carpal tunnel syndrome: Complex issues with a "simple" condition. *Neurology* 2001;56:1431-1432.
- 17. Fleckenstein JL, Wolfe GI. MRI vs EMG: which has the upper hand in CTS? *Neurology* 2002;58:1583-1584.