

Motor evoked potentials produced by transcranial magnetic stimulation is useful tool to assess cervical myelopathy patients

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I certify that there is no actual or potential conflict of interest in relation to this study and no funds and no benefits in any form has been or will be received.

diagnosis of cervical myelopathy

1. **Present history:** symptom, onset, past history
2. **Neurologic findings:** power strength, tendon reflex
3. **Image study:** magnetic resonance imaging, myelograms

Sometimes...

conclusive diagnosis is difficult

severe arthritis

peripheral nerve dysfunction

senile dementia

not all cord compression shown by magnetic resonance images is associated with cord dysfunction

Conduction in the descending corticospinal pathways

Transcranial magnetic stimulation TMS

Motor evoked potential MEP



quantitative assessment of corticospinal conduction

Barker AT, et al. 1985 *Lancet*

Purpose

To confirm the usefulness of MEPs for the assessment of the cervical myelopathy and to investigate the use of MEPs using TMS as a screening tool for cervical myelopathy



transcranial magnetic
brain stimulation

Patient sample

- 632 patients with symptom and sign suggestive of cervical myelopathy
- Sex : 383 males and 249 females
- Age: 28 to 89 years (mean 62.2)
- Between January 1995 and May 2010

Presenting symptoms : bilateral hand or feet numbness, difficulty walking, clumsiness or weakness of limbs.

All patients were provided informed consent prior to the initiation of the study.

Methods

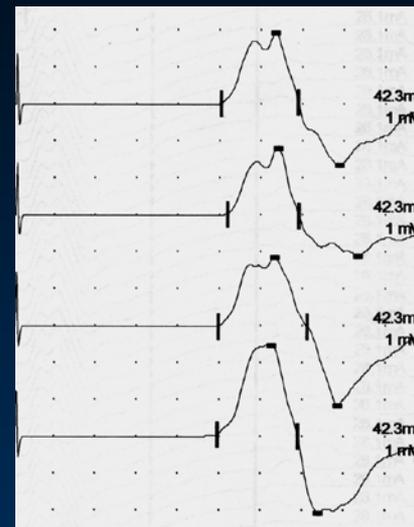
Transcranial magnetic brain stimulation (TMS)

(Magstim model 200, Viking IV)

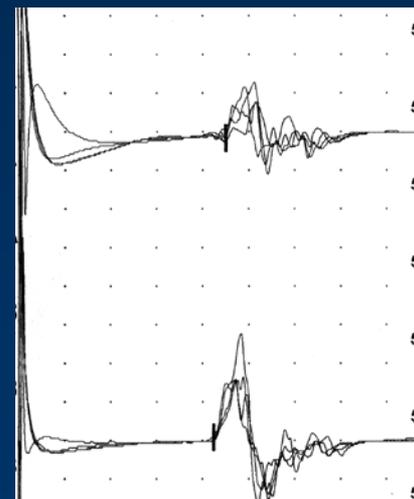
Motor evoked potentials (MEP)

latency

from the abductor digiti minimi (ADM)
and abductor hallucis (AH)



MEP



F-wave

Peripheral conduction time (PCT)

F-wave was obtained after ulnar and tibial nerve stimulation

$$\text{PCT (msec)} = (\text{M} + \text{F} - 1) / 2$$

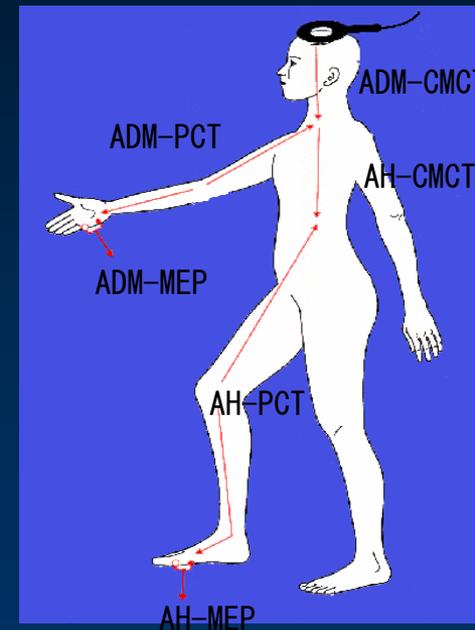
Methods

central motor conduction time : CMCT

$$\text{CMCT} = \text{MEP latency} - \text{PCT}$$

Kimura J, 1984, *Ann Neuro*

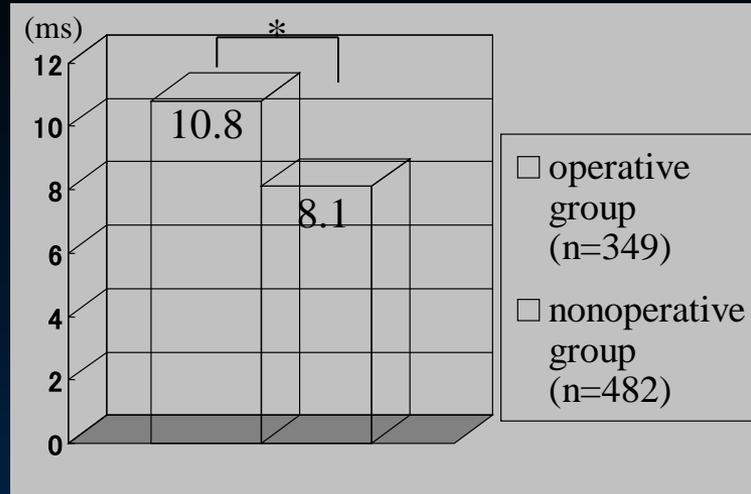
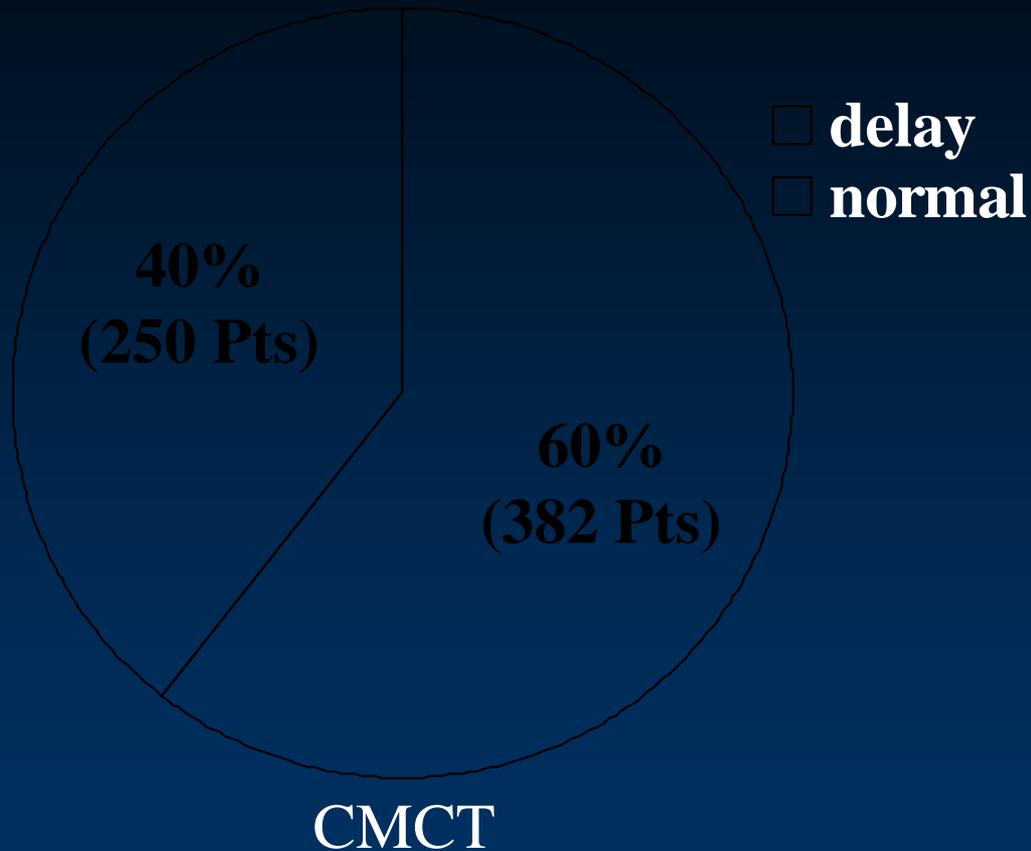
- Data which exceeded +2SD from the control data were considered to be abnormal findings.
- MEPs from the ADM over 5 phases were considered as abnormal findings.



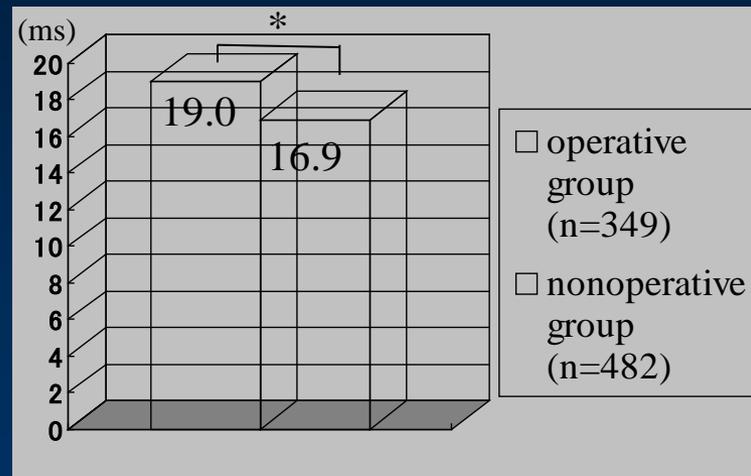
A total of 25 healthy controls were studied for comparison.

There were no complications concerning the examination.

Results



CMCTs from the ADM



CMCTs from the AH

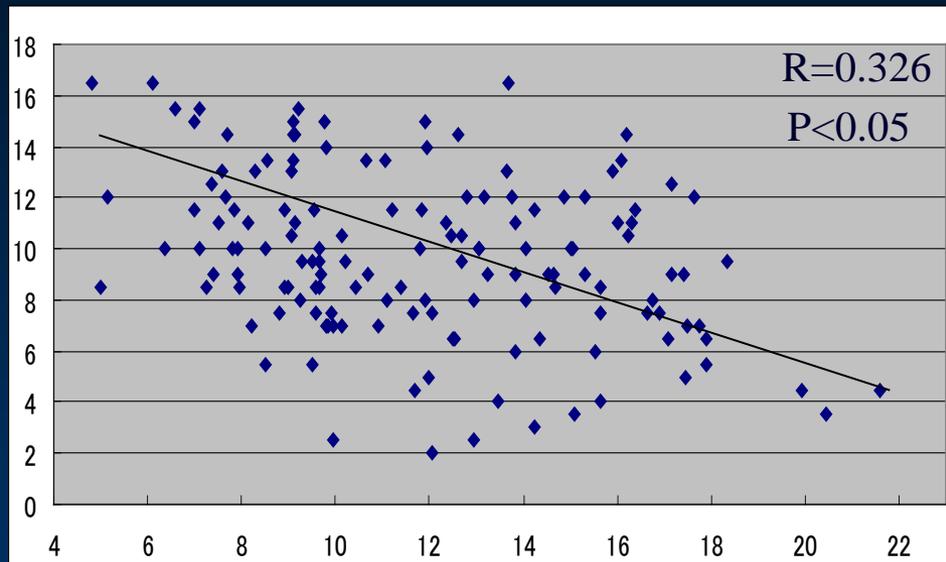
Mann-Whitney
U test * <0.05

In the operative group, 60% of patients showed prolongation of CMCT.

All patients in the operative group showed prolongation of MEP latencies or CMCTs or multiphase of the MEP wave.

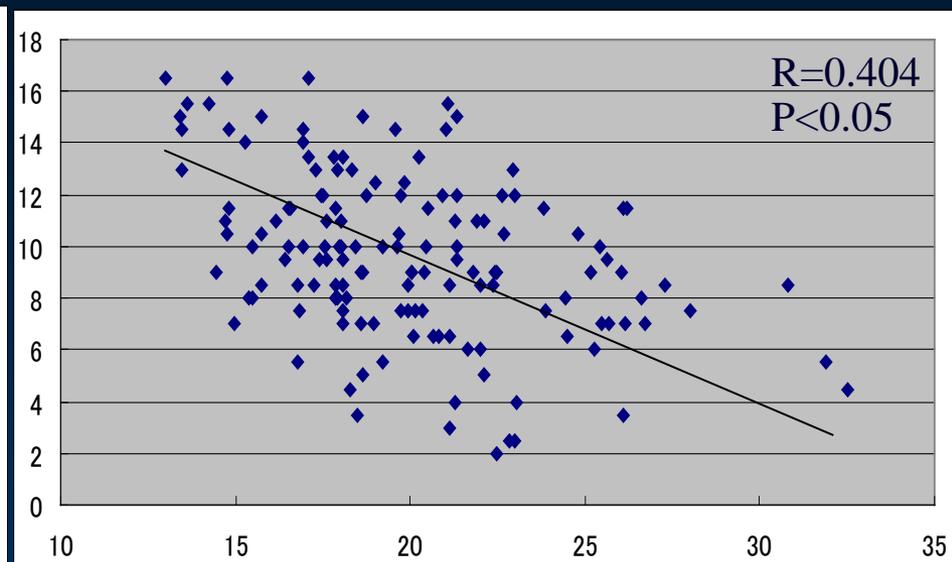
Correlation between Japan Orthopaedic Association Score (JOA score) and CMCT

JOA score



CMCT from ADM (ms)

JOA score



CMCT from AH (ms)

Discussion

632 patients with symptoms and signs suggestive of cervical myelopathy



- CMCTs were prolonged in 382 patients (60%)

An MEP study with TMS is a useful and non-invasive screening tool for an electrophysiological evaluation of cervical myelopathy patients.

Discussion

264 patients with operative treatment



- All patients showed prolongation of MEP latencies or CMCTs or multiphase of the MEP wave.
- CMCTs from the ADM and AH were significantly more prolonged than that in the nonoperative group.

CMCT may be effective parameters in spinal pathology when considering details of the operative treatment.

Conclusion

- **MEP studies using TMS are useful for an electrophysiological evaluation of cervical myelopathy patients.**
- **Moreover, CMCT may be effective parameters in spinal pathology when deciding the operative treatment.**