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CASE REPORT

THE IMPORTANCE OF MOTOR EVOKED POTENTIAL FINDINGS IN ACUTE-SUBACUTE ODONTOID DISLOCATIONS

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ABSTRACT

Purpose: Motor-evoked potentials (MEPs) evaluated with transcranial magnetic stimulation (TMS) allow functional evaluation of corticospinal conduction. The aim of this study is to evaluate the value of MEPs for the assessment of spinal cord transmission in clinically minimally symptomatic or asymptomatic patients with acute-subacute odontoid pathologies.
Material and Methods: The MEPs were measured from five cases with acute-subacute odontoid dislocations by using TMS. Demographic features, neurological examinations, and neuroimaging findings of the patients have also been recorded.
Results: The central motor conduction times (CMCTs) and MEP latencies were prolonged bilaterally in all patients with acute-subacute odontoid dislocation. Additionally, MEP amplitudes were also found to be decreased in all cases.
Conclusions: MEP is quite valuable to show involvement in clinically and radiologically silent cases. Our findings in acute-subacute cases without myelopathy showed us that the CMCTs were prolonged especially in the cases who had motor deficits but also in asymptomatic cases.

Keywords: motor evoke potentials, odontoid, acute, subacute, electrophysiology, adult

INTRODUCTION

Magnetic stimulation has been commonly used for the examination of the descending motor pathways. Motor-evoked potentials (MEPs) evaluated with transcranial magnetic stimulation (TMS) allow functional assessment of corticospinal conduction. [1]. In spite of that, there are limited TMS studies focused on acute odontoid pathologies other than common cervical spondylosis. The purpose of this study is to evaluate the value of MEPs in the assessment of dysfunction in spinal cord transmission in acute-subacute odontoid pathologies. Therefore we summarized the clinical, radiological, and MEP findings of five patients and present the clinical, electrophysiological, and radiological features of a case who underwent surgery.

MATERIALS AND METHODS

The electrophysiology unit records were reviewed for cases with acute-subacute odontoid dislocations. MEPs have been obtained by TMS. TMS was performed by the MagPro stimulator (Medtronic, Denmark) with a round coil. Cortical stimulation has been applied over the motor cortex at an optimum position for eliciting MEPs. The MEPs were recorded from the abductor digiti minimi (ADM) muscles at rest.

The shortest latencies of motor responses with brain stimulation (central latency–CL) and root stimulation (root latency–RL) and peak-to-peak amplitudes of the largest MEP after cortical stimulation were measured. Central motor conduction time (CMCT) was calculated by subtracting the RL from the CL. Demographic features, neurological examination, and neuroimaging findings of the patients have also been noted.

RESULTS

The ages of the patients were between 20-43. All the patients were female. Neurological examination was normal in two patients. Mild weakness in the upper extremities was observed in two of the other patients and hemihypoesthesia in one patient. Neuroimaging based on magnetic resonance imaging (MRI) revealed an odontoid fracture in four out of five, and odontoid pannus-related instability and upward dislocation in one patient. There weren't any intensity changes in the spinal cord in all these acute/subacute cases. (Table 1) The CMCTs and MEP latencies were prolonged bilaterally in all patients with acute-subacute odontoid dislocation. Additionally, MEP amplitudes were also found to be decreased in all cases. One patient underwent stabilization surgery and the MEP was repeated in the second week after surgery. The most notable change was observed in CMCT. Postoperative calculated CMCT was shorter than the previous one.

Case presentation:

A 20-year-old female was admitted to our clinic with the chief complaint of neck and arm pain which started two months ago after she fell down from a height. Her neurological examination revealed bilateral slight weakness in both proximal upper extremities. Motor strength was determined as 4/5 in bilateral arm flexion and abduction. There weren't any Babinski signs and increased deep tendon reflexes. Her cervical spinal MRI showed odontoid Type 2 fracture and posterior dislocation (Figure 1). Electrophysiological assessment (Table 1) showed bilaterally and significantly prolonged CMCT in ADM. Additionally MEP amplitudes, which were obtained after cortical stimulation were reduced (Figure 2). All these findings resemble severe deterioration of

Table 1. Clinical, electrophysiological and radiological features of the cases

	Age-Sex	Etiology	Neurologic examination	Stmulus-Record area	Right			Left		
					Latency ms	Amplitude mV	CMCT ms	Latency ms	Amplitude mV	CMCT ms
Case 1	20-F	Odontoid fracture	Motor strength is 4/5 in bilateral upper extremity proximal muscles	C8-ADM	10.6	4.6		11.0	3.9	
				Ctx-ADM	20.5	1.7	9.9	21.6	1.9	10.6
				Postoperative C8-ADM	10.6	2.6		11.0	1.9	
				Postoperative Ctx-ADM	19.4	0.5	8.8	19.7	0.4	8.7
Case 2	43-F	Odontoid pannus dislocation	Right sided hemihypoestesia	C8-ADM	10.2	8.0		11.0	7.1	
				Ctx-ADM	19.6	1.1	9.4	21.0	0.6	10.0
Case 3	33-F	Odontoid fracture	Normal	C8-ADM	12.3	8.9		12.3	6.9	
				Ctx-ADM	20.8	3.3	8.5	22.2	1.1	9.9
Case 4	43-F	Odontoid fracture	Motor strength is 4/5 in bilateral upper extremity distal muscles	C8-ADM	10.6	8.8		10.6	11.9	
				Ctx-ADM	25.5	0.6	14.9	26.1	0.8	15.5
Case 5	37-F	Odontoid fracture	Normal	C8-ADM	13.5	4.3		13.9	1.9	
				Ctx-ADM	21.8	2.8	8.3	21.8	2.1	7.9

cervical central motor conduction and also probable slight axonal loss in the cervical pyramidal tracts. The patient underwent surgery for cervical stabilization. The MEP investigation was repeated two weeks after the surgery. The investigation revealed a decrease in MEP latencies and CMCTs with cortical stimulation. Besides, the MEPs amplitudes were slightly lower than the former preoperative ones.

DISCUSSION

Radiological investigations which are commonly used in the suspected spinal pathologies demonstrate morphological abnormalities of the spine and the spinal cord but not functional impairment. Motor evoke potentials evaluation by TMS is a non-invasive method for assessing descending motor pathway function. MEP is commonly used in a wide range of spinal cord pathologies to localize the lesion and defines the severity of involvement and is accepted as a highly sensitive and reliable test [1,2]. TMS provides objective and quantitative information for motor pathways and can easily be compared across individuals [3]. Results obtained from different studies reveal that CMCT is correlated with clinical findings and radiographic parameters [1-5]. MEP is additionally sensitive to exhibiting corticospinal tract involvement which has not already been clinically evident [4].

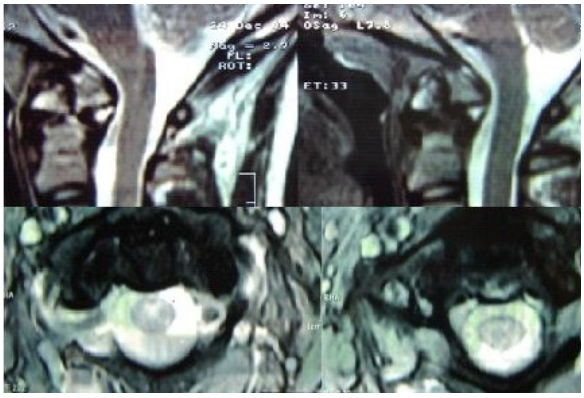

Figure 1. Axial and sagital T2 cervical MRI scenes of case 1.

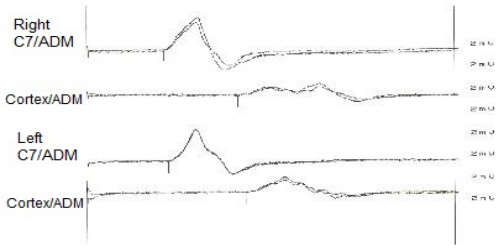

Figure 2. Case 1 bilateral MEPs elicit by TMS

TMS has some other additional advantages in neurology, neurosurgery, and orthopedic surgery clinics. It really has important advantages by being a quick, easy, and noninvasive test. Furthermore, this test method has also benefited in the evaluation of patients who have difficulty in transportation such as in the setting of trauma [1,6,7]. Additionally, this technic is very helpful to evaluate patients who have coexisting and confusing symptoms and pathologies [1,3].

Previous studies have indicated that MEPs might be a valuable tool in the functional assessment of different etiologies including spinal cord disorders, hereditary spastic paraplegia, and motor neuron disorders [4]. TMS mostly has been studied in chronic segmental compression of the spinal cord especially related to common spondylotic changes and disc herniations. It is accepted as a valuable tool in the functional assessment of subclinical cases [1,6,8]. The MEP investigation relevance was also investigated in acute spinal cord injury patients in one study and it revealed the same significance as in chronic cases [6].

Our findings in acute-subacute cases without myelopathy showed us that the CMCTs were prolonged especially in the cases who had motor deficits but also in asymptomatic cases. In addition, the cases who had motor deficits had more prolonged CMCTs. Our results in acute-subacute cases were compatible with the findings of all other research that studied different etiologies. MEP is quite valuable to show involvement in clinically and radiologically silent cases and the severity of dysfunction detected by MEP is correlated with the clinical severity. The main parameter that reflects the involvement of the corticospinal tract is CMCT. Recovery in CMCT can be observed even soon after the surgery for odontoid dislocation.

The clinical manifestations of odontoid dislocation-related pathologies are highly variable, being relatively asymptomatic to unstable with significant neurological deficits [9]. The Type II fractures that are the most common form observed in our patients are traditionally considered unstable and often require immediate surgical stabilization [7,9]. Although neurological assessment can be difficult in patients with unstable odontoid pathologies, MEP is effective

in clarifying the functional situation of the motor pathways.

Odontoid-related pathologies are rare and their electrophysiological features were mainly discussed for the pediatric age groups and intraoperative period in the literature [10]. Our study aims to discuss the value of perioperative electrophysiological evaluation of this rare condition in adult cases.

CONCLUSION

Early diagnosis and treatment of odontoid pathologies are actually important owing to their critical neighborhood of important areas of the central nervous system. Early diagnosis could be difficult in cases with no or mild clinical symptoms. MEP is a valuable tool for the assessment of functional involvement in these patients.

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