International Journal of Psychophysiology 92 (2014) 74–78

Contents lists available at ScienceDirect

International Journal of Psychophysiology

journal homepage: www.elsevier.com/locate/ijpsycho

Obsessive-compulsive disorder: A "sensory-motor" problem?

M. Russo [a], A. Naro [a], C. Mastroeni [b], F. Morgante [b], C. Terranova [b], M.R. Muscatello [b], R. Zoccali [b], R.S. Calabrò [a,*], A. Quartarone [b]

[a] IRCCS Centro Neurolesi Bonino-Pulejo Messina, Italy
[b] Department of Neuroscience, University of Messina, Italy

ARTICLE INFO

Article history:
Received 24 October 2013
Received in revised form 25 February 2014
Accepted 28 February 2014
Available online 11 March 2014

Keywords:
Obsessive compulsive disorders
Transcranial magnetic stimulation
Sensory-gating control

ABSTRACT

Obsessive–compulsive disorder (OCD) is a clinically heterogeneous condition. Although its pathophysiology is not completely understood, neurophysiologic and neuroimaging data have disclosed functional abnormalities in the networks linking frontal cortex, supplementary motor and premotor areas, striatum, globus pallidus, and thalamus (CSPT circuits). By means of transcranial magnetic stimulation (TMS) it is possible to test inhibitory and excitatory circuits within motor cortex.

Previous studies on OCD patients under medication have demonstrated altered cortical inhibitory circuits as tested by TMS. On the other hand there is growing evidence suggesting an alteration of sensory-motor integration. Therefore, the aim of the present study was to evaluate sensory-motor integration (SAI and LAI), intracortical inhibition, and facilitation in drug-naïve OCD patients, using TMS. In our sample, we have demonstrated a significant SAI reduction in OCD patients when compared to a cohort of healthy individuals. SAI abnormalities may be related to a dysfunction of CSPT circuits which are involved in sensory-motor integration processes. Thus, it can be speculated that hypofunctioning of such system might impair the ability of OCD patients to suppress internally triggered intrusive and repetitive movements and thoughts. In conclusion, our data suggest that OCD may be considered as a sensory motor disorder where a dysfunction of sensory-motor integration may play an important role in the release of motor compulsions.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

Obsessive–compulsive disorder (OCD) is a clinically heterogeneous condition, with a lifetime prevalence of 1–3%. OCD and related tic disorders (TD) share similar clinical phenomenology, a mutual comorbidity and heritability patterns.

Although its pathophysiology is not completely understood, neurophysiologic (Greenberg et al., 2000; Heinz et al., 2003; Leocani et al., 2001) and neuroimaging (Mataix-Cols et al., 2004) data have disclosed functional abnormalities in the networks linking frontal cortex, supplementary motor and premotor areas, striatum, globus pallidus, and thalamus (CSPT circuits) in both diseases.

Transcranial magnetic stimulation (TMS) is a non invasive technique, which allows to test inhibitory and excitatory circuits within motor cortex (Hallett, 2000). A useful technique applied in some studies (Maeda and Pascual-Leone, 2003; Orth, 2009) is the paired-pulse TMS. It is possible to test short intracortical inhibition (SICI) and intracortical facilitation (ICF) by using this technique. The physiology of these phenomena is relatively well understood. Indeed, growing evidences indicate that SICI and ICF respectively reflect the modulatory inhibitory and excitatory effects of cortico-cortical and subcortico-cortical networks on motor-cortex output neurons (Berardelli et al., 2008). In addition, it is possible to test short (SAI) and long-latency afferent inhibition (LAI) (Tokimura et al., 2000) by using paired-pulse protocol combining a peripheral stimulus (conditioning, CS) and a cortical one (test, TS). Pharmacological investigations have shown that both cholinergic and GABAergic circuitries are involved in SAI generation (Di Lazzaro et al., 2000, 2005), while the physiology of LAI is less understood.

TMS studies have found abnormalities in neuronal inhibition and facilitation within primary motor area in Tourette's syndrome, focal dystonia and, among other, in OCD which has significant clinical and familiar overlap with TD (Maeda and Pascual-Leone, 2003). It has been reported that OCD patients showed a significantly decreased SICI and active and resting motor threshold (aMT and rMT) with respect to healthy controls. The decrement of SICI and MT was greater in OCD patients with TD, but remained still significant in patients without TD (Greenberg et al., 1998, 2000; Ziemann et al., 1996a,1996b). In addition, patients with OCD demonstrated a significantly shortened Cortical Silent Period, which is a marker of $GABA_B$ergic function (Siebner et al., 1998), and increased ICF as a marker of glutamatergic neurotransmission (Chen et al., 1998) compared to healthy subjects (Richter et al., 2012). There are also evidences suggesting that SAI is reduced in patients suffering from Tourette Syndrome with OCD co-morbidity (Orth, 2009). Moreover, it has been reported that repetitive TMS (at 1 Hz for 20 min), applied to

* Corresponding author at: IRCCS Centro Neurolesi "Bonino-Pulejo", S.S. 113, Contrada Casazza, 98124 Messina, Italy. Tel.: +39 090 60128954; fax: +39 090 60128950.
E-mail address: salbro77@tiscali.it (R.S. Calabrò).

http://dx.doi.org/10.1016/j.ijpsycho.2014.02.007
0167-8760/© 2014 Elsevier B.V. All rights reserved.

the supplementary motor area in treatment-resistant OCD, increased SICI and cortical excitability measures correlated with the effective clinical response (Mantovani et al., 2013).

In keeping with these abnormalities of sensory-motor integration, Rossi et al. reported in OCD patients a smaller reduction of the amplitude of precentral (N30) sensory evoked potentials (SEP) during movement executions, as compared to control subjects in which they observed a greater, global reduction in pre- and postcentral SEP (Rossi et al., 2005). These abnormalities are likely due to the deficient inhibitory control on motor output coming from subcortical structures, such as basal ganglia and thalamus, which have been described as "hyperfunctioning" in OCD (Alptekin et al., 2001; Mataix-Cols et al., 2004; Rauch et al., 2001; Saxena et al., 2001; Pena-Garijo et al., 2010; Ping et al., 2013). The lack of inhibition, revealed by these neurophysiological studies, may underlie the clinical phenomenology characterized by the inability to suppress repetitive, intrusive and reverberating, movements, complex acts and intrusive thoughts (Cantello, 2002; Greenberg et al., 2000; Heinz et al., 2003; Leocani et al., 2001).

Although these studies suggest a widespread deficit on inhibitory mechanisms within sensory-motor cortex, one important limitation is that most of the patients were under treatment with psychoactive drugs, which could be an important confounding factor. It is worthy to underline that sensory-motor integration, whose alteration may play a key role in the physiopathology of OCD, has not yet been investigated by means of TMS. Hence, the aim of the present study was to evaluate sensory-motor integration and motor cortex excitability in drug naïve OCD patients using a TMS approach.

2. Methods

2.1. Subjects

The protocol was approved by our local ethics committee in accordance with the Declaration of Helsinki on the use of human subjects in experiments (1964). Each patient gave informed consent in written form. We studied 12 patients with OCD (7 men and 5 women, mean age 30.2 ± 4 years) and 12 healthy individuals (7 men and 5 women, mean age 32 ± 2 years). Diagnosis of OCD was defined according to DSM-IV criteria, after exclusion of other Axis I and/or II disorders by Structured Clinical Interview for DSM-IV (Leckman et al., 2010). The inclusion criteria were: right handers, according to the Edinburgh Handedness Inventory—Oldfield, 1971; drug-free and -naïve at the beginning of the study; no obvious neurological diseases and a score >16 reported in Yale Brown Obsessive–Compulsive Scale, Y-BOCS (Storch et al., 2010). Patients with history of epileptic fits; metallic component or electrical devices within head or neck; previous brain neurosurgery; medications altering, or with a presumed positive or negative effect on the level of cortical excitability, e.g. antiepileptics, neuroleptics, benzodiazepines, antidepressants, dopamine, fluoxetin, amphetamines; and positive pregnancy-test were excluded. General medical, neurological, psychiatric family history of patients and control subjects were unremarkable. Compulsions consisted of checking, hoarding, counting and washing.

2.2. Protocol

The electrophysiological parameters resting motor threshold (rMT), SICI, ICF, short afferent inhibition (SAI) and long afferent inhibitions (LAI) intervals were tested either in patients or in healthy volunteers.

2.3. TMS

Patients and controls were seated in a comfortable reclining armchair during the experiment. Both arms were supported by a pillow. They were asked to completely relax and to look straight ahead. TMS was given through a standard figure-of-eight-shaped coil connected to a Magstim 200 monophasic stimulator (Magstim 200; Whitland, Dyfed, UK). Mean coil loop diameters were 9 cm. The coil was placed tangentially to the scalp, with the junction region of the coil pointing backwards and laterally at a 45° away from the midline, at the optimum scalp position, named "motor hot spot", which consistently elicited the largest MEPs with the steepest initial slope from the right abductor pollicis brevis muscle (APB) and which was found using constant stimulus intensity and moving the coil over the head in steps of 5 mm. Stimulus intensity was set at a stimulator output that induced MEPs of about 0.8–1 mV in the target muscle.

2.4. TMS measures

First we measured rMT, defined as the minimum intensity that evokes a peak-to-peak MEP of 50 μV in at least 5 of 10 consecutive trials in relaxed muscle (Rossini et al., 1994). We then evaluated the active motor threshold (aMT) that is the minimum intensity, eliciting a reproducible peak-to-peak MEP of at least 200 μV in tonically contracting muscle in at least 5 of 10 consecutive trials. Audio-visual feedback of ongoing EMG activity was provided to ensure a constant force level. ICI and ICF were determined according to the protocol described by Kujirai et al. (1993). The intensity of the CS was set at 80% of aMT. The intensity of the TS was adjusted to elicit 0.8–1 mV peak-to-peak MEP amplitudes (approximately 115–125% of rMT). Stimulus intensities were kept constant. The delivery frequency was 0.5 Hz. SICI and ICF were assessed at ISIs of 2 and 10 ms, respectively. SAI and LAI were studied using the protocol described by Tokimura et al. (2000). An electric CS was given to the right median nerve at the wrist through a Digitimer D-160 stimulator (Digitimer Ltd, Welwyn Garden City, Herts, UK) prior to a magnetic TS given to the left M1. The median nerve was stimulated through a bipolar-electrode montage at the wrist (cathode proximal) using a square wave pulse with a pulse-width of 500 μs. The intensity was set just above the threshold for evoking a visible twitch of the thenar muscles (approximately 2.5-times perceptual threshold). The intensity of the TS and the frequency were the same as those of the ICI/ICF protocol. SAI and LAI were probed at ISIs of 25 and 200 ms, respectively. Forty stimuli were delivered at each ISI and randomly intermingled with 20 trials in which MEPs were elicited by the TS alone. The mean amplitude of the conditioned MEP was expressed as percentage of the unconditioned MEP mean amplitude. The relative change in MEP amplitude induced by the CS was taken as a measure of the strength of each parameter. Trials in which the APB muscle was not fully relaxed were excluded from analysis.

All raw data are reported in Table 1.

2.5. Electrophysiological data acquisition and analysis

EMG activity was recorded with Ag-AgCl surface electrodes from APB, using a belly tendon montage. The signal was amplified and band-pass filtered (32 Hz to 1 KHz) by Digitimer D-150 amplifier and stored at a sampling rate of 10 kHz on a personal computer for off-line analysis (Signal Software; Cambridge Electronic Design, Cambridge, UK). During the experiment, EMG activity was continuously monitored with visual (oscilloscope) and auditory (spea\kers) feedback to ensure either complete relaxation at rest or a constant level of EMG activity

Table 1
Absolute electrophysiological parameter values between individuals with OCD and healthy volunteers. A p-value <0.05 was considered significant (*).

	Patients (n = 12)	Controls (n = 12)	t-value	p-value
rMT (%)	36,3 ± 0,3	44,2 ± 0,8	9,7	<0,001*
SICI (mV)	1.09 ± 0.1	0.45 ± 0.02	4.5	0.003*
ICF (mV)	1.43 ± 0.2	1.41 ± 0.1	1.4	**0.5**
SAI (mV)	1.7 ± 0.2	0.6 ± 0.05	4.6	0.002*
LAI (mV)	0.52 ± 0.1	0.3 ± 0.04	1.9	0.4

Download English Version:

https://daneshyari.com/en/article/929624

Download Persian Version:

https://daneshyari.com/article/929624

Daneshyari.com