



Treatment of pudendal neuralgia by high-frequency rTMS of the medial wall of motor cortex bilaterally using an angled figure-of-eight coil

Dear Editor,

High-frequency repetitive transcranial magnetic stimulation (HF-rTMS) of the motor cortex was shown effective in treating chronic pain, in particular neuropathic pain [1]. A flat figure-of-8 coil is classically used, focusing cortical stimulation in the superficial layers of the motor cortex [2]. Deeper brain structures can be stimulated by other types of coils (e.g., double-cone or H-coil), but their value to modulate pain perception remains controversial [3]. In fact, these coils stimulate more deeply but also more broadly the brain. On the other hand, the B70 coil, which is an angled figure-of-8 coil consisting of two partially overlapping coils making an angle of 150°, stimulates deeply, while remaining focal [4]. To our knowledge, the B70 coil was only used to treat neuropathic pain in the lower limbs in a single case [5]. Compared to a flat figure-of-8 coil, the B70 coil more easily reaches the medial wall of the motor cortex bilaterally, where the pelvic muscles are represented, corresponding to the anterior extension of the paracentral lobule towards the supplementary motor area [6].

In the Pain Center of Grenoble University Hospital, HF-rTMS is used for several years in clinical practice to treat various chronic pain syndromes [7,8]. From our last study [8], we would like to focus on the interest of applying HF-rTMS with a B70 coil in a series of 18 patients suffering from perineal pain due to pudendal nerve entrapment syndrome (13 women and 5 men, age (mean $\pm$ sd): 60.4 $\pm$ 15.9 years, pain duration: 94 $\pm$ 64.7 months).

The rTMS procedure was performed using a MagPro stimulator (MagVenture, Farum, Denmark); each 10Hz-rTMS session consisted of delivering 2000 pulses in 20 minutes (40 trains of 5 sec with intertrain interval of 25 sec); the intensity of stimulation was set at 80% of the resting motor threshold; the B70 coil was held in posteroanterior orientation, centred on the vertex (Cz), without using neuronavigation for targeting. The therapeutic protocol included an induction phase: one rTMS session per day for five days during two consecutive weeks, followed by two sessions the next week (12 sessions). In patients who responded to rTMS (reduction in average daily pain intensity $\geq$ 30% on a 0–10 numerical rating scale), a maintenance phase of bi-monthly sessions for five months was undertaken (11 sessions).

Compared to the baseline, a significant decrease was found at the end of the induction phase (D21) regarding the average intensity of ongoing daily pain (from 5.4 $\pm$ 1.9 to 3.7 $\pm$ 3.0, p = 0.006, Wilcoxon signed-rank test) and paroxysmal daily pain (from 8.0 $\pm$ 1.8 to 3.8 $\pm$ 3.0, p = 0.005). The average number of painful paroxysms

was also reduced (from 5.7 $\pm$ 3.1 to 2.4 $\pm$ 2.5, p = 0.006). Regarding individual responses, pain reduction was $\geq$ 70% in 4 patients, between 30% and 49% in 8 patients, and $<$ 30% in 6 patients. The 12 responders (67%) entered in the maintenance phase.

Six patients (33% of the initial series and 50% of the responders to the induction phase) completed the study to the end of maintenance phase (D180). They had pain reduction $\geq$ 70% (n = 1) or ranging between 50% and 69% (n = 3) or between 30% and 49% (n = 2). Overall, the average intensity of ongoing and paroxysmal daily pain intensity remained stable between D21 and D180 (2.9 $\pm$ 3.0 vs. 2.8 $\pm$ 2.3, p = 0.75 and 3.8 $\pm$ 3.1 vs. 3.7 $\pm$ 3.1, p = 0.90, respectively). The average number of painful paroxysms was also stable (2.3 $\pm$ 3.0 vs. 2.9 $\pm$ 3.7, p = 0.16). In addition, compared to baseline, these patients showed a significant improvement of the Physical (but not Mental) Component Summary of the Short Form (36) Health Survey (from 33.8 $\pm$ 5.6 to 55.0 $\pm$ 15.7, p = 0.04).

Regarding the other 6 patients who entered the maintenance phase, 5 patients stopped the study because of pain recurrence and one patient was lost to follow-up.

A careful review of the literature only retrieved 5 articles on the use of rTMS to relieve pelvic or perineal pain, including two series of patients treated by repeated sessions [9,10]. In 12 patients with endometriosis [10], 5 sessions of HF-rTMS were applied over the left motor cortex with a flat figure-of-eight coil, leading to an average of 1-point reduction in pain intensity (from 5.1 to 4.1/10). In 13 patients with bladder pain syndrome [9], 10 sessions of HF-rTMS were applied over the whole motor cortex with an H-coil, leading to a more marked reduction in pain intensity (from 7.9 to 6.2/10). However, there was no previous study based on repeated sessions of HF-rTMS of the motor cortex for the treatment of pudendal neuralgia.

This study shows that repeated sessions of HF-rTMS applied to the vertex using a B70 coil could produce effective and sustained pain relief in some patients with refractory pudendal neuralgia. The average reduction in ongoing pain intensity (–1.7/10 at the end of the induction phase) was similar to that previously reported with a deep H-coil [9] and possibly higher than using a flat figure-of-eight coil [10], although it is difficult to make comparisons between these studies. If confirmed, it could mean that perineal pain can be relieved more effectively by a stimulation more appropriate to reach the medial wall of the motor cortex bilaterally in the depth of the interhemispheric fissure. Regarding the mechanisms of action, this result is in favor of specifically targeting HF-rTMS

on the cortical motor zone corresponding to the painful region, although unilateral focal stimulation of the motor cortex can also be effective for diffuse pain, especially non-neuropathic pain [1].

From a practical point of view, the use of a “deep coil” (B70, double-cone, or H-coil) facilitates rTMS application by avoiding the need for neuronavigation. Finally, the value of such “deep coils” for treating perineal pain could be extended for pain in the lower limbs, of which cortical representation also locates in the medial wall of the motor cortex in the depth of the interhemispheric fissure [6]. Some of our results support this hypothesis [5,8].

Declaration of competing interest

The authors have no conflicts of interest to declare.

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