



Epidural electrical stimulation to improve chronic poststroke aphasia: A 5-year follow-up

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Background

Aphasia is an incapacitating deficit experienced by almost 25% of patients after a left hemispheric ischemic stroke. Spontaneous recovery is considered to be limited to a period of 3 to 6 months. Although speech therapy performed during the first weeks may speed up this process and enhance its outcome, beyond this period it fails to change the global prognosis.

Objective

We report a case of an unusual recovery of nonfluent chronic poststroke aphasia subsequent to extradural cortical stimulation.

Methods

A right-handed woman experienced aphasia and drug-resistant central poststroke facial pain after a left superficial Sylvian ischemic stroke at the age of 58 years old. Four years after the stroke, the patient was included in a clinical trial to establish the efficiency of epidural electric stimulation on neuropathic pain. As an improvement in her language performance was noted, a speech evaluation was added to the initial protocol to quantify the benefit. Twelve months after the surgical implantation, pain and language performance were assessed in a double-blind manner during two consecutive 1-month periods when the stimulator was randomly enabled or disabled. The same evaluation was performed after 5 years of stimulation.

Results

Eventually, epidural electric stimulation significantly and sustainably improved her lexical access and speech fluency.

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Conclusions

Cortical stimulation may offer a new approach for the treatment of late chronic poststroke aphasia.
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Aphasia is experienced by almost 25% of patients after a left hemispheric ischemic stroke.¹ Most of the survivors will develop a persistent deficit depending on the severity and location of the ischemic episode. Aphasia is an incapacitating deficit that prevents people from having a normal social or professional life. Spontaneous recovery that occurs in a few patients after a stroke is considered to be limited to a period of 3 to 6 months.² Speech therapy performed during the first weeks may speed up this process and enhance its outcome. Beyond this period, speech therapy can still improve point deficits but fails to change the global prognosis.

To date, few studies have shown that cortical stimulation can facilitate poststroke recovery. Some authors have proposed that transcranial magnetic stimulation (TMS) may promote motor rehabilitation by enhancing neuronal reorganization.³ In a similar manner, there is evidence to suggest that TMS applied over Wernicke's area⁴ or that transcranial direct-current stimulation (tDCS) could enhance recovery in poststroke aphasia. In particular, it has been shown that patients who benefited the most from tDCS were those who experienced nonfluent aphasia or apraxia of speech with perilesional areas closest to the stimulation site.⁵ Nonetheless, the effects of these interventions are of a temporary nature. To sustain the improvement, the stimulation must be permanent and this effect can only be obtained by surgical epidural stimulation. Although the results of noninvasive stimulation trials on poststroke recovery seem encouraging, the potential role of implanted electric cortical stimulation in this field is still debated.

We report a case of a right-handed woman who recovered sustainably from chronic poststroke aphasia after epidural stimulation performed over the primary motor cortex of the dominant hemisphere.

Clinical report

History and examination

The patient had no untoward medical history when she experienced aphasia because of a left external capsular ischemic stroke (Figure 1, A-C) at the age of 58 years old. Investigations were made to determine the origin of her stroke but no underlying pathology such as carotid stenosis, occlusion, atheroembolic disease, or small-vessel intracranial vascular pathology was found. A few days after the stroke, the patient underwent a brief speech evaluation by an independent speech therapist. This evaluation revealed a moderate lexical deficit associated with naming deficits and phonemic

and verbal paraphasia. In the first months after the stroke, the patient completed a course of speech therapy that resulted in little improvement. When the case was studied, she did not receive speech lessons anymore. During the first few weeks after the ischemic episode, the patient did not suffer from any pain, only from aphasia. Thereafter, she began to suffer from central poststroke facial pain mostly affecting the periorbital region and the cheek on the right-hand side of her face. The patient described her pain as electric, burning, and crushing paroxysms triggered by coldness and while concentrating on reading. She experienced allodynia when touching her right-hand cheek. Her pain was rated at 8/10 on the Visual Analogue Scale (VAS). As she had been monitored for 4 years by pain specialists without significant benefit, she was included in a clinical trial to establish the efficiency of epidural electric stimulation on drug-resistant neuropathic pain. The clinical trial, aiming to establish the efficiency of epidural electric stimulation on drug-resistant neuropathic pain, was approved by the French ethics committee "Comité Consultatif de Protection des Personnes dans la Recherche Biomédicale (CCPPRB) – Région Auvergne" and was registered during the session that was held on April 4, 2003. The patient provided written informed consent for the procedure.

Operation

The primary motor cortex (M1) was located during surgery after a preoperative functional magnetic resonance imaging (fMRI) scan. Surgery was performed under general anaesthesia with muscle paralyzing agents used only during the induction. After focused scalp incision, a circular craniotomy was performed. A single quadripolar electrode (Resume, Medtronic, MN) was introduced into the extradural space overlapping the primary motor and sensitive cortices, at the level of the inferior frontal sulcus behind Broca's area (Figure 1, D). Position of the electrode was refined by three-dimensional neuronavigation techniques and electric cortical mapping that induced a motor-evoked response monitored by electromyographic recording. The electrode was fixed to the dura, leaving no dead space in between and subsequently connected to a stimulator (Itrel 3, Medtronic, MN) implanted in the subclavicular region.

Postoperative course and results

Twelve months after the surgical procedure, pain was assessed during two consecutive 1-month periods when the stimulator was randomly enabled (on) or disabled (off).

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