

Combined (Thalamotomy and Stimulation) Stereotactic Surgery of the VIM Thalamic Nucleus for Bilateral Parkinson Disease

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Abstract. Stereotactic thalamotomy of the thalamic nucleus ventralis intermedius (VIM) is routinely used for movement disorders. During this procedure, it has been observed that high-frequency (100 Hz) stimulation of VIM was able to stop the extrapyramidal tremor. In patients with bilateral tremor of extrapyramidal origin, who were resistant to drug therapy, the therapeutic protocol associated (1) a radiofrequency VIM thalamotomy for the most disabled side, and (2) a continuous VIM stimulation for the other side using stereotactically implanted electrodes, connected to subcutaneous stimulators.

VIM thalamotomy relieved the tremor in all operated cases. Side effects were mild and regressive. VIM stimulation strongly decreased the tremor but failed to suppress it as completely as thalamotomy did. This was due in part to the fact that programmable stimulator frequency rate is limited to 130 Hz, while it appeared that the optimal stimulation frequency was 200 Hz. This therapeutic protocol appears to be of interest for patients with bilateral extrapyramidal movement disorders.

Ventralis intermedius (VIM) thalamotomy appears to be the most widely used stereotactic procedure for the relief of various kinds of tremor. During electrical stimulation to control the placement of the electrode, we observed that high-frequency stimulation of the VIM nucleus induced contralateral paresthesias and suppressed the tremor,

in a reversible manner, and improved the drawing of figures such as spirals. We thought that this effect could be used as an adjuvant therapy to contralateral thalamotomy, without the deleterious complications of the bilateral thalamotomy.

Under local anesthesia, a radiofrequency VIM thalamotomy [3, 4] (AC-PC level, posterior quarter of AC-PC line, 13.5 mm from midline) was performed on the side corresponding to the most important tremor. During the same session, a chronic stimulating electrode (Medtronic Pisces) was implanted on the less disabled side.

VIM thalamotomy: 18 patients (9 Parkinson and 9 other dyskinesias) not responding to *L*-dopa were submitted to VIM thalamotomy. Initial results were excellent (total disappearance of tremor) in 16 patients, moderate in 1 and bad in 1. Postoperative complications were observed in 11 patients (7 transitory and 4 permanent).

VIM stimulation: (A) Test during surgery: At low frequency (50 Hz, 0.5 ms), paresthesias were usually induced in the contralateral hand. At high frequency (100 Hz, 0.5 ms, 1–2 V), paresthesias were still present but the tremor was blocked instantaneously and reappeared immediately after the end of the stimulation. During the blockade, voluntary movements were normally performed and drawing of a spiral was greatly improved. This was also observed in other structures [1].

(B) Chronic VIM stimulation: 6 patients were implanted into VIM with deep brain electrodes. No complications occurred. 3 patients were greatly improved and were connected to permanent stimulators.

(C) Combined surgery: In one case of Parkinson's disease, we combined a thalamotomy of VIM in the right thalamus and a chronic implantation of electrode into the left VIM. The thalamotomy had an excellent but transient effect on the tremor on the right side. The VIM stimulation did not suppress the tremor completely on the left side, which was however strongly improved.

Although still experimental [2], VIM stimulation appears to be a helpful additional therapy to thalamotomy, which could provide a way to manage patients with bilateral dyskinesias without side effects.

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