Tremor-predominant Parkinson's disease treatment

- Parkinson's Disease: Current Treatment Modalities and Emerging Therapies
- Magnetic resonance-guided focused ultrasound thalamotomy for tremor
- Comparison of Dentatorubrothalamic Tractography Methods Based on the Anatomy of the Rubral Wing
- Patient-Reported Outcomes After Focused Ultrasound Thalamotomy for Tremor-Predominant Parkinson's Disease
- Connectomic Basis for Tremor Control in Stereotactic Radiosurgical Thalamotomy
- Focused Ultrasound Thalamotomy: Correlation of Postoperative Imaging with Neuropathological Findings
- Focused ultrasound and other lesioning in the treatment of tremor
- Magnetic Resonance Image Guided Focused Ultrasound Thalamotomy. A Single Center Experience With 160 Procedures

see Parkinson's disease treatment.

see Tremor treatment.

Treatment includes oral medications, injections with botulinum toxin and neurosurgical procedures. Some of the first-line medications (levodopa, dopamine agonists, anticholinergics) are very effective in controlling tremor. However, some patients with Parkinson's disease tremors are unresponsive to first-line drugs, and treatment with second-line medications (clozapine, amantadine, clonazepam, propranolol, Neurontin) should be attempted. In the small number of patients with disabling tremor that is refractory to all medications, neurosurgical intervention should be considered.

Surgery

Several predictors have been identified that may influence the effects of subthalamic nucleus (STN) versus thalamic (VIM) lesions for the treatment of Parkinsonian tremor. In particular:

Tremor characteristics:

Patients with predominantly tremor-dominant Parkinson's disease and relatively mild bradykinesia/rigidity tend to respond very well to thalamic (VIM) targeting.

Patients whose tremor is associated with more generalized Parkinsonian symptoms (like akinesia, rigidity, postural instability) often benefit more from subthalamic nucleus (STN) targeting, since STN interventions can improve multiple motor domains, not just tremor.

Disease progression:

Early-stage patients or those with isolated tremor might do better with thalamic VIM lesioning.

More advanced disease stages, particularly with progression beyond tremor, usually favor STN targeting.

Cognitive and psychiatric status:

STN lesioning or stimulation can sometimes have more cognitive and psychiatric side effects (especially executive dysfunction, depression, or apathy) compared to thalamic interventions. Thus, patients with fragile cognitive/psychiatric profiles might be better candidates for VIM targeting.

Laterality and dominance:

Thalamotomy (VIM lesion) on the dominant tremor side can be very effective with minimal side effects if the tremor is unilateral.

For bilateral tremor, bilateral VIM lesions are risky (high dysarthria/dysphagia risk), so bilateral STN approaches are usually considered safer if broader benefits are needed.

Imaging and anatomical factors:

Some studies using MRI-based targeting and tractography suggest that patients whose tremor circuits (dentato-rubro-thalamic tract) are easily targetable from the VIM may do better with thalamic lesioning, while those with a broader basal ganglia dysfunction circuit may benefit more from STN approaches.

Response to medications:

Tremor that is levodopa-resistant sometimes responds better to VIM targeting than to STN targeting.

In summary:

Pure tremor, mild disease → VIM.

Mixed symptoms, more advanced disease → STN.

Cognitive fragility → Prefer VIM.

Bilateral need → Prefer STN [1].

Both thermocoagulation and deep brain stimulation at several different neuroanatomical sites (thalamus, globus pallidus, subthalamic nucleus) offer good to excellent tremor control with relatively low risk to the patient [2].

Patients with Tremor-predominant Parkinson's disease (PD) achieve more improvement in tremor control after Combined Unilateral Posteroventral Pallidotomy and Ventral Intermediate Nucleus Thalamotomy [3].

Focused ultrasound thalamotomy for patients with TDPD demonstrated improvements in medication-refractory tremor by CRST assessments, even in the setting of a placebo response [4].

1)
Paschen S, Natera-Villalba E, Pineda-Pardo JA, Del Álamo M, Rodríguez-Rojas R, Helmers AK, Hensler J, Deuschl G, Obeso JA, Martínez-Fernández R. Are there Predictors for the Effects of Subthalamic Versus Thalamic Lesions for the Treatment of Parkinsonian Tremor? Mov Disord. 2025 Apr 27. doi: 10.1002/mds.30216. Epub ahead of print. PMID: 40289571.
2)
Marjama-Lyons J, Koller W. Tremor-predominant Parkinson's disease. Approaches to treatment. Drugs Aging. 2000 Apr;16(4):273-8. Review. PubMed PMID: 10874522.
3)
Fayed ZY, Radwan H, Aziz M, Eid M, Mansour AH, Nosseir M, Anwer H, Elserry T, Abdel Ghany WA. Combined Unilateral Posteroventral Pallidotomy and Ventral Intermediate Nucleus Thalamotomy in Tremor-Dominant Parkinson's Disease versus Posteroventral Pallidotomy Alone: A Prospective Comparative Study. Stereotact Funct Neurosurg. 2018 Sep 18;96(4):1-6. doi: 10.1159/000492229. [Epub ahead of print] PubMed PMID: 30227440.
4)
Bond AE, Shah BB, Huss DS, Dallapiazza RF, Warren A, Harrison MB, Sperling SA, Wang XQ, Gwinn R, Witt J, Ro S, Elias WJ. Safety and Efficacy of Focused Ultrasound Thalamotomy for Patients With Medication-Refractory, Tremor-Dominant Parkinson Disease: A Randomized Clinical Trial. JAMA Neurol. 2017 Oct 30. doi: 10.1001/jamaneurol.2017.3098. [Epub ahead of print] PubMed PMID: 29084313.