Posterior Subthalamic Area (PSA) stimulation for Parkinson’s disease

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History

- Old target
- Lesion
- DBS

→ Resurgence

Stereotaxic Interventions on the Zona Incerta Area for Treatment of Extrapyramidal Motor Disturbances and their Results

By F. Mundinger

Thalamotomy of the oral ventral nuclei, which was first proposed by Hassler, effects a good and lasting removal or improvement particularly of Parkinsonian symptoms [3, 4, 8, 9, 11]. Out of a total number of 2604 stereotaxic operations (May 25, 1965), in cooperation with Rinchert. We performed 1058 thalamotomies and 732 palidotomies with our stereotaxic apparatus [6, 7, 9, 12, 15, 16, 17]. Most of these subcortical interventions were carried out in cooperation with Hassler. There is a nearly linear correlation between the clinical effect and the extent of destruction of the nuclei and their afferent pathways. On account of the individual variations in size it is, however, not in every case possible to obtain a complete destruction of the nuclei [13] except with excessively large lesions that increase the risk of complications. On the other hand a destruction of the basal parts of the v. o. a., the v. o. p. and their afferent pathways [5, 14] is sufficient for producing a good improvement. Thus it is possible to keep the lesion smaller and to spare the frontalothalamic connections passing for the most part dorsally, which is important for bilateral interventions.

The alternative way is to place the destruction primarily in the subthalamus [1, 19a and b] where the extrapyramidal systems pass in neuronal concentrations. Spiegel and Wyceis, however, deliberately exclude the zona incerta and the bundles H₁, H₂ [19b]. For our purpose I have worked out a special route of puncture in order to coagulate in the region of the zona incerta including H₁, H₂, the dentatothalamic connections and parts of the radiatio praemniscalis and the rostro-lateral-dorsal ruber [5]. The intention was to place the lesion as much as possible in the axial part of these fiber structures. An indirect approach was necessary for this purpose (Fig. 1).
What is the PSA?

2 Components:

1. Caudal Zona Incerta
2. Prelemniscal Radiation

Plaha et al, Brain 2006
Where is the PSA?
Trajectory – through VIM/VOP
When: PSA for PD?

1. Tremor – alternative to thalamus

2. ART/Motor fluctuations – alternative to STN
When: PSA for PD?

1. Tremor – alternative to thalamus
   → Promising

2. ART/Motor fluctuations – alternative to STN
   → Unconvincing
Why: PSA for PD tremor?

• Can explore PSA under VIM/VOP
  • Nothing to lose!

• 3387 can span both thalamus and PSA
PSA vs VIM/VOP

- PSA *may* have better;
  - Efficacy; tremor suppression/lower thresholds
  - Side effect profile; more transient

→ Evidence not definitive

Sandvik et al, Neurosurgery 2012
Why: PSA for motor fluctuations?

* Did not correct for preop Ldopa motor response

* Effect on akinesia and rigidity could be current spread to STN?
PSA Vs. STN

For

Stimulation of the caudal zona incerta is superior to stimulation of the subthalamic nucleus in improving contralateral parkinsonism.

PSA: Better for akinesia, rigidity and tremor

Against

Unilateral caudal zona incerta deep brain stimulation for Parkinsonian tremor

PSA: Good tremor suppression only
PSA Vs. STN

FOR PSA

Stimulation of the caudal zona incerta is superior to stimulation of the subthalamic nucleus in improving contralateral parkinsonism

FOR STN

Pallidal versus Subthalamic Deep-Brain Stimulation for Parkinson’s Disease

Neurostimulation for Parkinson’s Disease with Early Motor Complications

A Randomized Trial of Deep-Brain Stimulation for Parkinson’s Disease
PSA in PD: When and Why

• Tremor as alternative to thalamus