Pallidotomy

Neurosurgical procedure whereby a electrode is placed in the globus pallidus internus for radiofrequency, interrupting pallidofugal pathways.

Before the advent of levodopa, pallidotomy was initially the most effective treatment for Parkinson's disease, but it was soon superseded by thalamotomy. It is widely unknown that, similar to Lars Leksell, 2 neurologists from Göttingen, Orthner and Roeder, perpetuated pallidotomy against the mainstream of their time. Postmortem studies demonstrated that true posterior and ventral pallidoansotomy sparing the overwhelming mass of the pallidum was accomplished. This was due to a unique and individually tailored stereotactic technique even allowing bilateral staged pallidotomies. In 1962, the long-term effects (3-year follow-up on average) of the first 18 out of 36 patients with staged bilateral pallidotomies were reported in great detail. Meticulous descriptions of each case indicate long-term improvements in parkinsonian rigidity and associated pain, as well as posture, gait, and akinesia (e.g., improved repetitive movements and arm swinging). Alleviation of tremor was found to require larger lesions than needed for suppression of rigidity. No improvement in speech, drooling, or seborrhea was observed. By 1962, the team had operated 13 patients with postencephalitic oculogyric crises with remarkable results (mean follow-up: 5 years). They also described alleviation of nonparkinsonian hyperkinetic disorders (e.g., hemiballism and chorea) with pallidotomy. The reported rates for surgical mortality and other complications had been remarkably low, even if compared to those reported after the revival of pallidotomy by Laitinen in the post-levodopa era. This applies also to bilateral pallidotomy performed with a positive risk-benefit ratio that has remained unparalleled to date. The intricate history of pallidotomy for movement disorders is incomplete without an appreciation of the achievements of the Göttingen group [1)].

Types

Unilateral pallidotomy

Bilateral pallidotomy

Pallidotomy has long been an accepted procedure and the indications for this surgery, in the opinion of the responding centers of a survey of current practice in North America (1996), were rated on a scale of 1 (poor) to 4 (excellent) and demonstrated dyskinesia as the best indication (median = 4); on-off fluctuations, dystonia, rigidity, and bradykinesia as good indications (median = 3); and freezing, tremor and gait disturbance as fair indications (median = 2). Most centers used MRI alone (50%) or in combination with CT scan (n = 6) or ventriculopathy (n = 5) to localize the target. The median values of pallidal coordinates were: 2 mm anterior to the midcommissural point 21 mm lateral to the midsagittal plane and 5 mm below the intercommissural line. Microrecording was performed by half of the centers (n = 14) and half of the remaining centers were considering starting it (n = 7). Main criteria used to define the target included the firing pattern of spontaneous neuronal discharges (n = 13) and the response to joint movement (n = 10). Most centers performed motor (n = 26) and visual (n = 23) macrostimulation. Twenty four centers performed test lesions using median values of 55 degrees C temperatures for 30 s. Final lesions consisted of 3 permanent lesions placed 2 mm apart, each lesion created with median values of 75 degrees C temperatures for 1 minute. Median

hospital stay was 2 days [2].

Indications

Pallidotomy Indications.

100 Most Cited Articles

Agrawal et al. performed a search of the Web of Science database on 19 October 2020 using the keyword “pallidotomy.” The top-100 cited articles found were arranged in descending order on the basis of citation count (CC) and citation per year (CY). Relevant conclusions were derived.

The 100 top-cited articles were published between 1961 and 2017, in 24 journals. The average CC and CY were 118.1 (range - 856-46) and 5.326 (range - 29.52-2.09), respectively. The 3 most prolific authors were Lang AE (Neurologist - Toronto), Lozano AM (Neurosurgeon - Toronto), and Vitek JL (Neurologist - Atlanta). The Journal of Neurosurgery published the highest number of top-cited articles [Neurology. 1960;10:61-9]. The maximum articles were from the USA. University of Toronto and Emory University were the most productive institutions.

Pallidotomy has gone through several ebbs and flows. Unilateral pallidotomy is currently recommended for the treatment of motor symptoms of Parkinson's disease and dystonia. The need for further research and improved technology to make the technique safer and prove its efficacy is highlighted, especially keeping in mind a large number of populations to which the prohibitively expensive deep brain stimulation is unavailable [3].

Case series

36 patients (age range 31-73 years (mean age 56.2±3.2 years) were enrolled in study. Mean duration of PD was 9.8±1.1years. All patients used levodopa-drugs, mean levodopa dose was 1075±304.1 mg/day. Mean duration of motor fluctuations and levodopa-induced dyskinesias before surgery was 2,18±0,8 years. Patients = were divided into 2 groups - 22 patients underwent stereotactic unilateral pallidotomy and 14 patients underwent bilateral DBS (STN target). Neurological and psychological status assessed before and after treatment by: UPDRS II, Hoehn and Yahr scale, Schwab and England scale, MMSE, Beck's Depression Inventory, Hamilton Depression Rating Scale, Hamilton Anxiety Rating Scale and PDQ-39. Surgery performed on CRW stereotactic system. Postoperative follow-upranged from 1 to 8.5 years (mean 4.1±1.1 years). Regression of tremor, rigidity, bradykinesia and levodopa-induced dyskinesia observed in most patients after stereotactic interventions. The best results were achieved in patients who underwent DBS. In this group UPDRS II score improved by 74% in ON period and by 63% in OFF period. After pallidotomy UPDRS II score improved by 55% in ON period and by 47% in OFF period. Levodopa-induced dyskinesia stopped in 21 from 22 (95.5%) patients who had it before surgery after unilateral pallidotomy and in 11 from 12 (91.7%) patients after DBS. Surgical complications occurred in 3 (13.6%) case after pallidotomy, which induced transient neurological deficit. Our results demonstrate that both stereotactic interventions - pallidotomy and DBS are effective and safe methods of treatment of PD with levodopa-induced dyskinesias and motor fluctuations. Both surgeries improve overall motor function, increased patient's mobility and improve quality of life [4].

1)
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Favre J, Taha JM, Nguyen TT, Gildenberg PL, Burchiel KJ. Pallidotomy: a survey of current practice in North America. Neurosurgery. 1996 Oct;39(4):883-90; discussion 890-2. PubMed PMID: 8880789.
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