

Thalamotomy for Parkinson's Disease.

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Parkinsonism is a symptom complex consisting of resting tremor, bradykinesia, rigidity, and impaired postural reflexes. James Parkinson described this disease for the first time and named it as "Shaking Palsy". This study, conducted in the department of Neurosurgery, Lahore General Hospital, Lahore, included 94 patients. Of these 94 patients, males were 77 (82 %) and females 17 (18 %). Maximum number of patients, 35.4 %, were in the 5th. decade of life. Over 60 % patients had unilateral symptoms. Unilateral thalamotomy was performed in 84 patients (89.4%) while 10 patients (10.6 %) had bilateral thalamotomy for bilateral disease. Excellent control of tremors was achieved in 82.9 % patients while it was 68.1 % in case of rigidity. Minor complications of thalamotomy included headache, vertigo, vomiting and fever while major complications included temporary hemiparesis, aphasia, meningitis, pneumonia and death.

Key words : Parkinsonism, tremor, rigidity, leksel, thalamotomy.

Parkinsonism is a symptom complex consisting of resting tremor, bradykinesia, rigidity, and impaired postural reflexes(3). James Parkinson in 1817 described for the first time a disease which he named as "Shaking Palsy", its Latin synonym being "paralysis agitans": Involuntary tremulous motion, with a propensity to bend the trunk forward, and to pass from a walking to a running pace: The senses and intellects being unimpaired. He also gave precise and detailed description of the disease and its natural course^{1,2}.

The writings of Cooke (1840), Todd, and Marshall Hall as well as those by Graves, and Elliotson helped disseminate information about paralysis agitans, and directed readers to Parkinson's original account¹.

Although he himself used the term paralysis agitans, Trousseau (1861) noted that it seemed an inappropriate name, since "there is no paralysis at the commencement of this strange form of chorea". Charcot (1861) considered that the most striking and fundamental symptom of paralysis agitans is tremor^{1,6}.

Material and Methods

This study was conducted in the department of Neurosurgery, Lahore General Hospital, Lahore from January, 1994 to December, 1998. The study included 94 patients. Patients of all age groups and of either sex were included in the study. Selection of patients for surgery was done as laid down in international criteria: Tremor responds best to stereotactic surgery, rigidity next and bradykinesia least. So those patients were excluded from the study who had bradykinesia as the predominant symptom. All the patients were assessed and screened for hypertension, diabetes mellitus or any other systemic illness and managed accordingly before they underwent surgery. C.T. scan brain was done in all the patients to exclude any organic lesion. Stereotactic thalamotomy was done in all the patients. We used Leksel Stereotactic System and air ventriculography to localize the target (ventrolateral nucleus of thalamus) and then produce the

lesion. The patients were discharged within 3-4 days after surgery. Those patients who had bilateral symptoms were advised to come after 3-6 months for surgery on the opposite side.

Results

This study comprised of 94 patients. Of these 94 patients, males were 77 (82 %) and females were 17 (18 %). Age distribution is as shown in table 1.

Table 1 Age distribution

Age	No. of patients	%age
31-40 years	14	15.0 %
41-50 years	22	23.5 %
51-60 years	33	35.4 %
61-70 years	25	26.1 %

Out of the total 94 patients, 58 had the symptoms on one side (61.7%) while 36 patients (38.3%) came with bilateral disease. Of the patients with unilateral disease, 28(29.8%) had it on right side and 30(31.9%) on the left side. Unilateral thalamotomy was performed in 84 patients (89.4%) while 10(10.6%) patients needed bilateral thalamotomy for bilateral disease. Results of thalamotomy are shown in tables 2 & 3.

Table 2 Outcome after Thalamotomy - Tremor Control

Outcome	No. of patients	%age
Excellent	78	82.9 %
Good	9	9.6 %
Improved	4	4.3 %
Not improved	3	3.2 %

Table 3 Outcome after Thalamotomy- Rigidity Control

Outcome	No. of patients	%age
Excellent	64	68.1 %
Good	12	12.8 %
Improved	16	17.0 %
Not improved	2	2.1 %

Like any surgical procedure, thalamotomy also has some complications. In this study, minor complications included headache, vertigo, vomiting and fever (table 4) while major complications included temporary hemiparesis, aphasia, meningitis, pneumonia. All of these patients improved

within weeks. One of the patients died due to chest infection. (table 5).

Table 4 Minor Complications of Thalamotomy

Complication	No. of complications	%age
Headache	46	48.9 %
Vomiting	21	22.3 %
Vertigo	8	8.5 %
Fever	6	6.4 %

Table 5 Major Complications of Thalamotomy

Complication	No. of complications	%age
Hemiparesis	3	3.3 %
Meningitis	3	3.3 %
Pneumonia	2	2.2%
Aphasia	1	1.1%
Death	1	1.1%

Discussion

Parkinsonism is a neurodegenerative disorder with symptom complex consisting of resting tremor, bradykinesia, rigidity, and impaired postural reflexes^{2,3,5,11,19}.

Parkinson's disease appears to be more common in Europe and North America (an estimated 100-200 persons with Parkinson's disease among every 100,000 persons) than in Japan, China, and Libya, where rates are generally lower (between 30 and 80 persons with Parkinson's disease among every 100,000 persons)¹⁶.

Etiologically Parkinsonism can be classified as:

- ① Parkinson's Disease (Idiopathic).
- ② Infections (encephalitis lethargica, encephalitides, syphilis).
- ③ Toxins (manganese, carbon monoxide, carbon disulfide, cyanide, methanol).
- ④ Pharmacologic causes (neuroleptics, reserpine, lithium, alpha-methyl dopa).
- ⑤ Multiple system atrophies and degenerative diseases.
- ⑥ CNS disorders (normal pressure hydrocephalus, cerebral infarction, brain tumors, trauma).
- ⑦ Metabolic causes (hypothyroidism).
- ⑧ Hereditary causes (Wilson's disease, Huntington's disease, Hallervorden-Spatz disease)⁵.

Selective degeneration of the dopaminergic nigrostriatal pathway is the central pathologic process in Parkinson's disease. The resulting reduction in striatal dopamine concentration results in the emergence of the signs and symptoms of parkinsonism^{2,5,9,12,13}.

The presence of Lewy bodies is a histologic hallmark of Parkinson's disease. These intraneuronal, cytoplasmic inclusions are found in pigmented cells of the substantia nigra as well as in the hypothalamus, locus ceruleus, raphe nuclei of the midbrain and rostral pons. Lewy body is a highly specific marker of neuronal degeneration in Parkinson's disease. Lewy body is proteinaceous in nature¹².

Bradykinesia is the most characteristic symptom of basal ganglia dysfunction in Parkinson's disease. Tremor (course, 4-8 Hz, and pill-rolling) is one of the most recognizable symptom of this disease and it results from nigrostriatal degeneration and consequent disinhibition of

the pacemaker cells in the thalamus. The loss of balance associated with propulsion and retropulsion is perhaps the most disabling of all parkinsonian symptoms and results from degeneration of globus pallidus^{2,4,9}.

Changes in the mental state of patients with Parkinson's disease are so frequently encountered that they are universally accepted as part of the disease. These include depression, anxiety and dementia^{2,6}.

Patients with idiopathic Parkinson's disease often manifest signs and symptoms of autonomic nervous system dysfunction as well. Interestingly Parkinson's disease is considered to be a movement disorder that spares the sensations^{7,10}.

Medical treatment of Parkinson's disease includes anticholinergics, antihistaminics, antiviral (amantadine) and dopamine replacement therapy. Dopamine replacement therapy is currently the primary means of treating Parkinson's syndrome and is based on an attempt to restore dopamine within the substantia nigra and neostriatum. In 1960, levodopa (L-dopa), the amino acid precursor to dopamine, was introduced for the treatment of Parkinson's disease. L-dopa is the most effective agent for symptomatic treatment of Parkinson's disease (therapeutic "gold standard"), though it does not appear to alter the progression of the disease. Furthermore, L-dopa loses its efficacy with time. Anticholinergics and amantadine are also given in combination with levodopa but they have certain limitations and side-effects as well^{5,13,15,17,19}.

Surgical treatment of Parkinson's disease started as quite extensive open procedures which had considerable morbidity and mortality. Horsely, in 1890, performed excision of the motor cortex. Division of pyramidal tracts in cervical cord was done by Putnam in 1940 and of cerebral peduncle by Walker in 1949. Cooper performed occlusion of anterior choroidal artery to treat the disease.

Stereotactic surgery was introduced by Clarke and Horsely in 1906 when they tried it on animals and in 1920 Clarke thought to use it in humans. Spiegel used it for the first time in humans in 1947^{9,11}. Now a days different forms of stereotactic surgery are the mainstay of surgical treatment, the commonest being stereotactic thalamotomy and pallidotomy. Thalamotomy is superior to pallidotomy⁸. Parkinson's disease is the most common motor disorder for which stereotactic surgery is done¹¹. Different stereotactic frames used are Leksell, Bertrand, Guiot, Narabayashi, Riechert, Sugita, Talairach and Todd-Wells¹⁴.

Stereotactic surgery for Parkinson's disease involves interruption of the extrapyramidal pathways in Forel's field or in the ventrolateral nucleus of the thalamus. Different methods of making the lesion are mechanical, cooling probes, thermal lesions and Laser. Tremor responds best to stereotactic surgery, rigidity next and bradykinesia least. On the other hand, bradykinesia responds best to L-dopa treatment, rigidity next and tremor the least^{2,11,18}.

Analysis of our study shows that Parkinsonism is the disease of advancing age. The incidence of the disease is increasing with each decade of life, maximum number of patients being in the fifth decade (35.4%), while 85 % of the patients are above the age of 40 years (table 1). It is also clear from this study that the disease predominantly affects the males (82%) as compared to females (18%).

In our study, 61.7 % of the patients had unilateral disease and 38.3 % had bilateral symptoms. But when we look at the figures of thalamotomies being done on these patients, bilateral thalamotomies were done in only 10.6% of the total patients. The reasonable explanation of this discrepancy may be that as in patients with bilateral disease the side to be operated first was decided by the patient himself and in the majority of the cases it was for the right sided tremors. In these patients with the dominant(right) side becoming functional after thalamotomy, and secondly the disease being less marked on the other side, these patients did not bother to come for the tremors of the non-dominant side except in 10 % patients only.

As tremor responds best to stereotactic surgery, in our study tremor control was excellent in 82.9 % patients and good in 9.6%, combining these two makes a figure of over 92 % (table 2). As rigidity is the next to respond to thalamotomy, control of rigidity was excellent in 68.1% patients and good in 12.8%. It becomes over 70 % in combination (table 3). Bradykinesia responds least to thalamotomy. So those patients were excluded from the study that had bradykinesia as the predominant symptom. Most series report satisfactory relief of tremor in 85-93% of well-selected patients and improvement of rigidity and bradykinesia in 50 percent or more^{9,18}.

Like any surgical procedure, thalamotomy also has some complications. In this study, minor complications included headache, vertigo, vomiting and fever (table 4). These complications are due to the surgical procedure and air ventriculography. All these complications were transient and settled with the passage of time and with simple symptomatic measures. The major complications in this study included hemiparesis, aphasia, meningitis, pneumonia and death (table 5). Hemiparesis and aphasia improved gradually with a short course of steroids and physiotherapy. Infective complications (pneumonia & meningitis) were treated with antibiotics. The single death in this study was due to severe chest infection in a very old patient, not actively mobile before surgery.

As shown by the international literature, neurological complications are usually transient and mild but significant complications may occur in 4 to 6% of patients. These may include intracerebral hemorrhage and hemiparesis^{9,18}. Mortality is 0 to 1%, so the risk of stereotactic surgery compares favorably with the risk of medical management. The risk increases over the age of 60 and definitely over

the age of 65. The risk in hypertensive patients is particularly acute and requires control before surgery. Surgery should be avoided in patients who have mental deterioration¹⁸.

Conclusion

- Parkinsonism is the disease of the old age (61.5 % above 50 years) and males are predominantly affected (82 %).
- Thalamotomy is an excellent treatment option in patients with clear indications and if performed by an expert - excellent control of tremor (82.9 %) and rigidity (68.1 %) can be achieved.

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