

EXPERIENCES AND RESULTS IN PREFRONTAL LEUCOTOMY :  
A CLINICAL STUDY OF 339 LEUCOTOMIZED PATIENTS.

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FROM October, 1947, to October, 1952, we have had the opportunity of performing prefrontal leucotomy on 339 patients at the Neurosurgical Clinic in Belgrade. As this operation is of importance in the treatment of mental disease we consider it necessary to report our experiences and our results.

We analysed the methods of surgical treatment in mental cases in general, and especially in various forms of psycho-neurosis, and having judged the results which had been published, we almost immediately decided in favour of standard prefrontal leucotomy. We used this method in almost all cases in our series, with certain modifications in some cases.

The first patients sent to us by the psychiatrists were mainly serious and chronic schizophrenics who had been treated for years without success. As far as psychic recovery was concerned the results were fairly good in the first series, so the psychiatrists later sent us patients more suitable for leucotomy, i.e., patients in the first years of their illness as soon as shock treatment had proved unsuccessful.

The psychiatrists made their choice of patients for operation and set forth the indications for leucotomy. According to the diagnosis and form of schizophrenia the surgeon would decide on a certain modified method of prefrontal leucotomy. The indications against immediate prefrontal leucotomy were: high temperature, active tuberculosis, suppurative processes, heart diseases and general weakness. Such patients had to undergo preliminary treatment before the operation.

METHOD OF OPERATION.

In most of the cases of schizophrenia leucotomy was performed under a local anaesthetic, the patient being given sufficient doses of narcotics as a preliminary measure. Agitated patients were given a general anaesthetic with intravenous pentothal sodium. Later we made certain modifications in the Duff-Moniz operative procedure. Skin incision over the coronal suture directed towards the pupils. A  $\frac{1}{2}$  in. trephine or burr hole and a wide enlargement of the trephined opening was used. The leucotome was inserted through the dura, which had been opened in cruciate fashion, and was inserted as far as the posterior part of the orbital wall. This was followed by a subcortical severing of the frontothalamic paths just in front of the anterior horn of the lateral ventricle,

first on one side and then on the other side. When there was suspicion of a hydrocephalus, the position of the anterior horns was ascertained by a puncture with a cannula and leucotomy was performed anterior to the ventricles. The severing was performed as extensively as possible, mainly subcortically and anterior to the ventricles. Kennedy's observations on the importance of an extensive section and its direction in the white substance in the results of leucotomy are undoubtedly correct and have been empirically confirmed by us.

With a view to achieving more favourable results with regard to mental recovery and in order to avoid ill-effects in certain cases we made slight changes in the standard leucotomy already described, these being insignificant modifications in the plane and extent of incision, i.e., we performed so-called selective leucotomies. In the case of highly agitated and more active patients we made more extensive section of the upper parts of the frontothalamic paths, sparing the gyrus cinguli on the inner side. In the case of patients with obvious emotional trouble, the severing of the parts at the base was more extensive. With a view to better orientation in the blind severing of the white matter of the brain, we used a specially constructed Duff leucotome which, owing to its outer localizer, greatly facilitated the described modification of prefrontal leucotomy.

All our patients stood leucotomy comparatively well and without any special visible outward reaction. Rarely, haemorrhage, usually from the veins, may occur during the operation as an immediate complication, it comes from superficial vessels of the brain and can be quickly and easily checked. It appears to us that more serious haemorrhage occurring immediately after the section with Duff's leucotome is an exceptionally rare complication, and during the whole series of 339 patients we encountered it only once. When post-operative haemorrhage was suspected we took X-ray pictures with Myodil in several cases as a check-up. This was done according to the method of Sjöqvist and others. In this manner one can check the scope of prefrontal leucotomy and possible intracerebral haematoma by the radiographic appearances.

In the method of leucotomy which we have used, the cutting of the basal ganglia and pyramidal paths and the consequent appearance of enuresis, disorientation and pathological reflexes (Babinski) is extremely rare. During operation we noticed no conspicuous phenomena referable to the vegetative centres, no significant changes in blood pressure, pulse, breathing or temperature. During the first few days after operation these were all more or less normal. During the first few days the temperature usually rises to 38° C. The effects of oedema of the brain and minor haemorrhages in the brain are rarely observed clinically and are mild and transient when they occur. Likewise sweating, akinesia, aphasia, amnesia and a positive Babinski sign rarely occur, and if they do, pass quickly. In a small number of cases there were post-operative complications in the form of convulsions of the epileptic type, usually Jacksonian. In the whole of our series of 339 leucotomies, there were epileptic attacks only in 11 cases (about 3 per cent.), and of this number only three were permanent. In one of the latter there had been attacks before the operation. It is undeniable that there are advantages of a technical character (better orientation during section, better haemostasis, etc.) in the open method which is advocated by

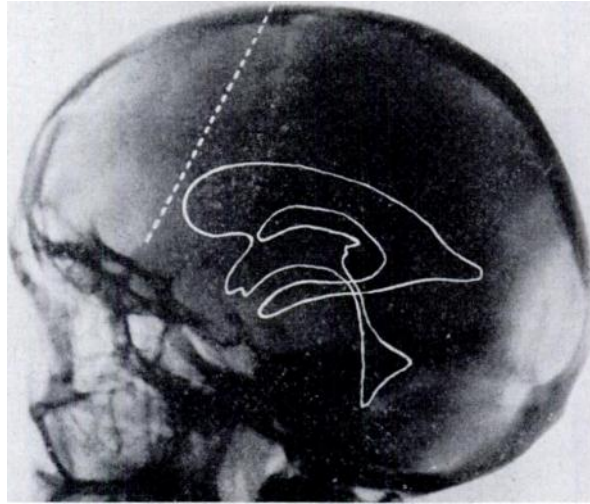


FIG. 1.—Direction of standard prefrontal section (indicated by dotted line).

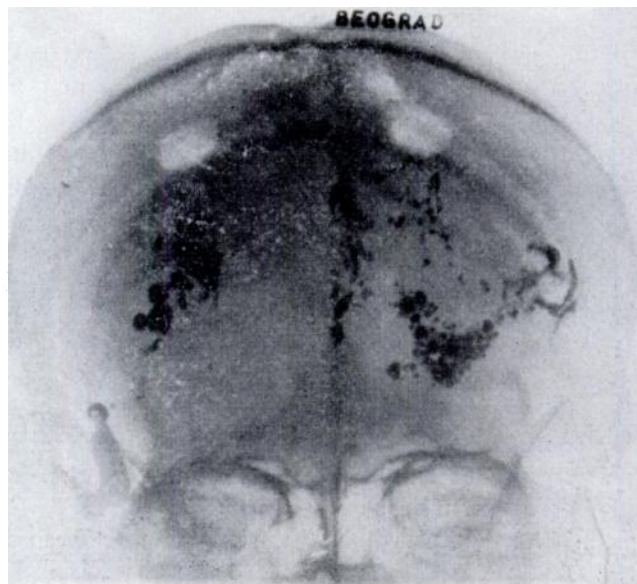


FIG. 2.—Myodil x-ray A-P picture of head immediately after leucotomy.

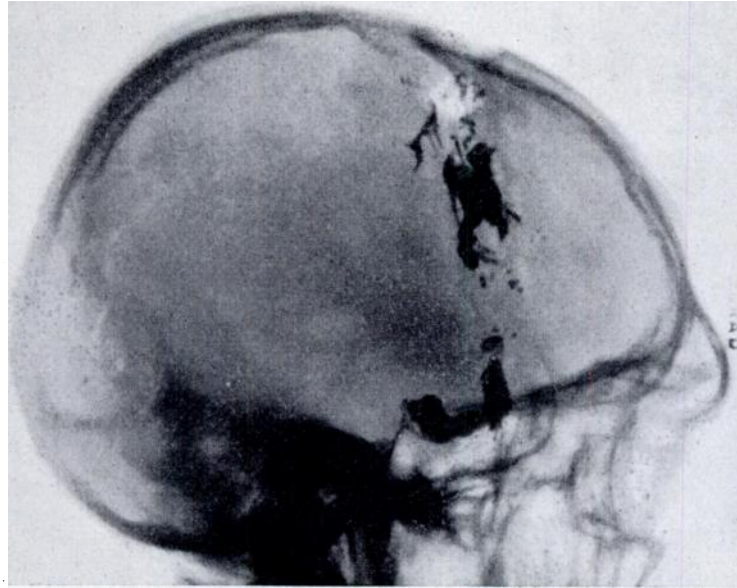


FIG. 3.—The same case, x-ray lateral picture of the head (excludes post-operative intracranial haemorrhage).

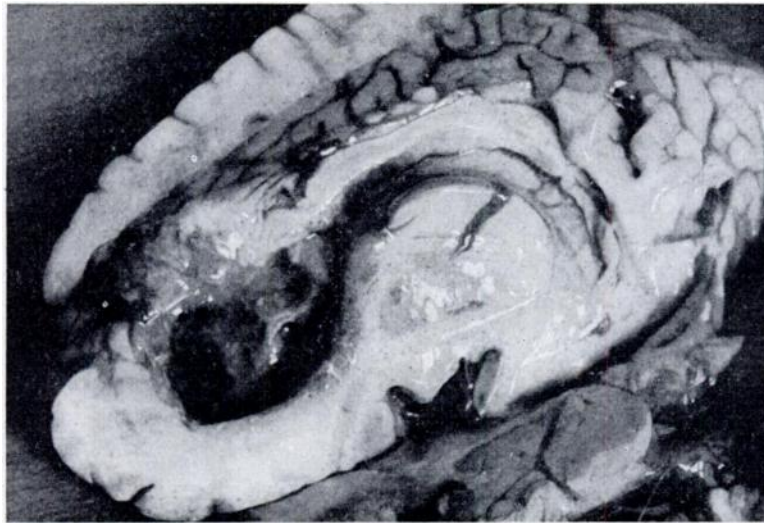


FIG. 4.—Post-mortem specimen : hematoma in the right frontal lobe. (Patient R. K—, 27 years old ; death occurred 16 hours after leucotomy.)

Lyerly, Poppen and others. It is likewise true that the contemporary modification of leucotomy of the closed type (Moniz, Duff) gives equally good results in mental recovery, and does not represent a serious operation which might have serious complications (haemorrhage, convulsions, etc.) such as are encountered in the open method of prefrontal leucotomy. Among the closed modifications we strictly avoid the transorbital leucotomy of Fiamberti, now recommended by Freeman, Moore and others, and which many neurosurgeons consider a most unsurgical method. This is a completely blind procedure, in which it is impossible to control intracranial haemorrhage.



FIG. 5.—Brain specimen : post-mortem finding eight months after leucotomy. (Female patient, V. K—, 12 years old.)

#### OPERATIVE MORTALITY.

In our series of 339 leucotomies we had 10 fatal cases, which constitutes a mortality of about 3 per cent. The postmortem showed post-operative haemorrhage—intracranial haematoma—as the cause of death in only two cases. In one case the arteria cerebri anterior had been severed, causing a haematoma. Apart from this there were oedema of the brain, fatty degeneration of the heart and miliary tuberculosis of the lung on both sides. In the remaining eight cases, the cause of death in three was degeneration of the heart muscle, in two a brain abscess and in three meningo-encephalitis. The infection was probably of endogenous origin. Later another four patients died in the mental hospital from various intercurrent diseases which had no connection with the leucotomy. Among these there was a patient, V. K—, 12 years old, whose post-mortem examination, eight months after the operation, showed subcortical incisions in front of the anterior horns in both frontal lobes, not communicating with the lateral ventricles. The case reported by McGrath was similar, the post-mortem, performed 5½ years after the successful operation, showing degenerative changes in the thalamus and primary injury of the brain.

### MENTAL CHANGES.

Immediately after leucotomy there were often dramatic changes in the mental condition. Mental recovery usually appeared in the form of a relaxing of the emotional strain, the absence of affective symptoms and psychomotor agitation. Apart from this in most of the cases paranoid obsessions and various kinds of hallucinations disappeared. Our psychiatrists noticed that if the early psychic changes, such as excitement, disorientation, apathy, euphoria and objectionable behaviour, did not disappear immediately after the operation, they usually disappeared in the course of the first few weeks. In the same series, we also noticed, but much less frequently (about 6 per cent.), certain moderate negative psychic phenomena which rather change the personality of the patient, and which in a small number of cases are permanent.

Mental improvement usually appears in the course of the first 3 to 4 months after leucotomy. Therefore it was only several months after the operation that we were able to ascertain definitely whether there were any psychic changes, either for better or for worse. Taking into consideration all these points, as well as the definite mental changes, the psychiatrists assessed the results of the operation according to the degree of mental recovery and classified the cases in three groups: First group: complete recovery or practically cured, (these were able to return to their former occupation and to work satisfactorily). Second group: considerably improved, able to do simple work, able to keep the general rules of hygiene, interested in their surroundings and cause no disturbances. Third group: mental condition unchanged; obliged to remain in mental hospitals. According to this assessment, prefrontal leucotomy in the schizophrenic cases, performed on 301 patients in various stages of the disease and on patients of various ages, after a shorter or longer illness, gave the following definite results:

### RESULTS OF PREFRONTAL LEUCOTOMY.

From October, 1947, till October, 1952, 339 patients in all were operated upon. Among these, 301 cases suffered from schizophrenia, 14 from psychoneurosis, 16 from imbecility, 3 from intractable pain owing to inoperable carcinoma and metastasis, and 2 from serious neurasthenia. Totalling 301 cases of schizophrenia, i.e., 89 per cent., and 38 cases suffering from other diseases, i.e., 11 per cent.

#### *Statistics of 301 Cases Leucotomized for Schizophrenia.*

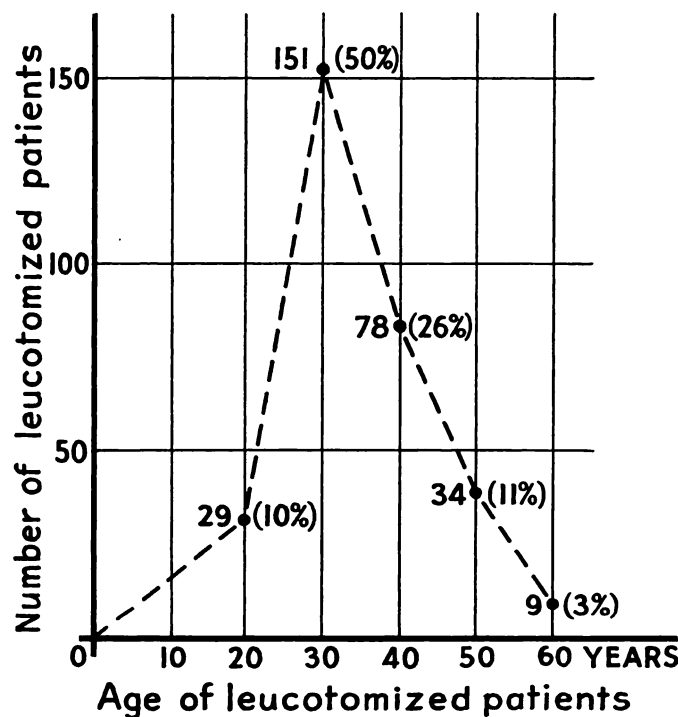
Males 183 (61 per cent.); females 118 (39 per cent.).

#### *Operated Cases by Age:*

- In the second decade: 29 (10 per cent.).
- In the third decade: 151 (50 per cent.).
- In the fourth decade: 78 (26 per cent.).
- In the fifth decade: 34 (11 per cent.).
- In the sixth and upwards: 9 (3 per cent.).

*Form of Schizophrenia :*

- Hebephrenia 119 cases (39 per cent.).
- Catatonia 98 cases (33 per cent.).
- Paranoid state 84 cases (28 per cent.).
- Re-leucotomy (among 301 cases of primary leucotomy) performed in the case of a relapse : 9 cases (3 per cent.).



*Results of Leucotomy in Schizophrenia.*

Number of operated cases.	Form of schizophrenia.	Practically cured.	Considerably improved.	Condition unchanged.	Relapses.	Operative mortality.	Died later.	Total mortality.
119	Hebephrenic.	30 (25%)	43 (36%)	33 (28%)	8 (7%)	3 (2%)	2 (2%)	5 (4%)
98	Catatonic	17 (17%)	45 (46%)	32 (33%)	—	3 (3%)	1 (1%)	4 (4%)
84	Paranoid state	21 (25%)	33 (39%)	24 (29%)	1 (1%)	4 (5%)	1 (1%)	5 (6%)
301	Total schizophrenic	68 (23%)	121 (40%)	89 (30%)	9 (3%)	10 (3%)	4 (1%)	14 (5%)

*Graphic Illustration of the Results of Leucotomy.*

Practically cured and considerably improved : Total, 189 cases (63 per cent.)	
Condition unchanged : 89 cases (30 per cent.)	
Relapses : 9 cases (3 per cent.)	
Operative mortality : 10 cases (3 per cent.)	
Died later : 4 cases (1 per cent.)	

Leucotomy was likewise performed in 14 cases of serious psychoneurosis (obsessions and various forms of phobia) : 5 males and 9 females. Their ages varied from 20 to 50. All earlier conservative treatment had been without results. The illness had lasted from 5 to 10 years. The results of leucotomy : cured 8, improved 5, and one unchanged.

One male and one female patient were leucotomized for serious neurasthenia. The illness had lasted for 2 years. One case showed a good result, while the second remained unchanged.

We performed prefrontal bilateral leucotomy in three cases of intractable pain caused by inoperable cancer and metastasis. The patients were all over forty. After operation the intractable pains disappeared and the patients no longer asked for drugs. All three patients died later. The post-mortem showed metastasis in various organs. According to the experiences of Lyerly bilateral leucotomy is surer than unilateral section in the case of intractable pain.

#### COMMENT ON THE RESULTS.

Most of our patients were chronic schizophrenics, who were leucotomized 5, 6 or even more years after the illness had begun. All of them, without exception, had previously been subjected to shock treatment which yielded no results. A large proportion of these patients were hopeless patients and were considered incurable. About 60 per cent. of our patients were up to 30 years old, while the remainder were in their fourth, fifth and sixth decades. 61 per cent. were males and 39 per cent. females. In most of the cases the same psychiatrists who had treated them before the operation judged the post-operative results. We have considered only the results of leucotomized patients from five years ago till four months ago.

Undoubtedly many factors influence the operative results. Among these we must mention age, sex, duration of the illness, general condition of the patient, the kind of preoperative treatment, general living conditions, etc. Among the factors also to be mentioned are various organic disturbances of the brain, such as secondary symptoms after meningitis, encephalitis, as well as cases of idiopathic cerebral atrophy (with convulsions and other symptoms) ; all these can often be discovered during leucotomy. Opinions as to whether these phenomena influence the results of leucotomy performed for psychosis still differ. Margolis reported a case of serious schizophrenia with an extensive hydrocephalus, where psychometric studies 15 months after leucotomy had been made, showed only slight remains of the organic changes in more serious damage of the brain. According to the psychiatrists of the State Mental Hospital in Belgrade, the average results after leucotomy were better in females than in males. Chronic patients, who had suffered for 5, 6, 10 and even more years, usually showed results as good as those obtained in patients who had been operated on much earlier. It appears that the form and stage of schizophrenia has a greater influence on the operative results than the actual duration of the illness. It likewise appears that organic changes in the brain, which are frequently discovered, only slightly influence the results of prefrontal leucotomy as a whole. We had slightly more recovered cases of the paranoid forms than



of catatonic forms and hebephrenia. The statistics of other authors show roughly the same results. (Gillies, Hickson, Mayer-Gross, *Brit. Med. J.*, 8 March, 1952; Smolik and others, *Postgrad. Med.*, 3, 179, March, 1948; according to E. A. Smolik and others, St. Louis University, *The 1948 Year Book of Neuropsych. and Neurosurgery*, Chicago.)

It is an undisputable fact that the personality of the patient has a considerable influence on the operative results, whether it be intact or more or less changed and deteriorated. A considerable number of our patients showed a more or less deteriorated personality before the operation. This will be referred to in detail by the psychiatrists who treated them at some other time. Ström-Olsen and others particularly stress the importance of an intact personality in chronic cases, and they have set more precise indications for prefrontal leucotomy in order to obtain better results in the sense of social rehabilitation after the operation. The definite results of leucotomy reported by Gillies and Hickson likewise point in this direction.

Of the 189 recovered cases which left hospital, there were relapses in 9 cases. This number of 9 cases, i.e., 3 per cent. out of 301 operated cases reported up to the present, does not represent a large percentage and we believe that in reality it is larger, considering the seriousness and chronic character of the operated cases as well as the incomplete replies obtained in the following-up of the condition of the operated schizophrenics. Of the 9 cases of relapse, only three showed a perceptible improvement.

Of the total number of 339 standard leucotomies performed in this series, 10 patients died, which represents an operative mortality of 3 per cent. In only two of these cases was severe haemorrhage of the brain the direct cause of death. According to the total statistics of various authors, this complication in the form of post-operative haemorrhage is no rarer in the open method of leucotomy, under direct vision.

#### SUMMARY.

In the course of the last 5 years, from 1947 till 1952, we performed altogether 339 standard prefrontal leucotomies and we have set forth the definite operative results for schizophrenias, operated on from 5 years ago till 4 months ago. An analysis of the results shows that prefrontal leucotomy is almost as satisfactory in different forms of schizophrenia as in cases of psychoneurosis, and without any significant differences in the recovery which might be in connection with the duration of the illness or with the age of the patient. The results are considerably better in the case of patients with a pre-operatively intact personality.

In the reported series of 301 schizophrenics operated upon the total of favourable operative results amounts to 63 per cent.; while the condition remained unchanged in 30 per cent., there were relapses in 3 per cent., operative mortality amounting to 3 per cent. This means that in this series of schizophrenics about two-thirds of the patients were able, after the operation, to leave hospital and live at home, socially rehabilitated. Of these two-thirds about one-half returned to their former occupation and to a normal life. These results represent a considerable social-economic success.

Finally we wish to express our thanks to the psychiatrists of the Neuro-psychiatric Clinic of the State Mental Hospital in Belgrade for their professional collaboration in the assessment of the operative results achieved.

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