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Prefrontal leucotomy : an ex post facto archival study of a complete hospital sample.

Michael. Joschko
University of Windsor

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PREFRONTAL LEUCOTOMY: AN EX POST FACTO ARCHIVAL STUDY OF A COMPLETE HOSPITAL SAMPLE

by
Michael Joschko
B. Sc. McMaster University, 1975

A Thesis
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ABSTRACT

Extensive life history data were compiled on 377 psychiatric patients who underwent prefrontal leucotomy during the period 1952-1967. Equivalent data were compiled for a group of 16 patients rejected for the operation, and for 100 controls matched to 100 randomly chosen leucotomized patients. There were no systematic differences indicated in the leucotomy-random leucotomy, random leucotomy-control, and combined leucotomy-rejected-for-leucotomy group comparisons. Seventy-one "successful" leucotomy patients were selected and compared to the remaining "unsuccessful" patients. The successful group was strikingly differentiated from the unsuccessful group on a number of good prognostic indicators. Analyses, in psychosurgery research, at the level of the single case are recommended.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

A recent multidisciplinary symposium on psychosurgery (Fried, 1974) has highlighted the need for the systematic and impartial collection of data on both past and present psychosurgical procedures. Even a cursory review of the literature (Breggin, 1972; Hitchcock, Laitinen & Vaernet, 1972; Laitinen & Livingston, 1973; Turnbull, 1968; Valenstein, 1973) clearly shows the discrepancy between the large amount of clinical evidence and the paucity of accepted, integrated conclusions regarding the efficacy of psychosurgery.

Essentially there are three mutually exclusive positions espoused in the psychosurgery controversy (Annas & Glantz, 1974). A number of neurosurgeons and psychiatrists (Hirose, 1972; Kalinowsky & Hippius, 1969; Knight, 1972; Lewin, 1973; Scoville, 1973; Sweet, 1973) subscribe to the 'middle of the road' view that psychosurgical techniques have gone beyond the experimental stage, and are specifically indicated for certain types of patients. At one end of the spectrum, the Senate Health Subcommittee's inquiry into human experimentation (Kennedy, 1974) has held that psychosurgery has potentially therapeutic effects, but is still experimental, and therefore must be subjected to appropriate controls. In contrast, Breggin (1972, 1973) is the most vocal proponent of the third position, which calls for the immediate prohibition of psychosurgery, on moral and ethical grounds, regardless of its therapeutic or experimental status.

Only a substantial review of past data, together with careful study of ongoing psychosurgical programmes, can reconcile these three competing

points of view.

The purpose of the present study is to assess objectively and impartially some of the effects of a specific psychosurgical procedure by utilizing an ex post facto archival design. The role of this study is best seen as a step towards Chorover's (1974) recommendation that:

> A registry and assessment mechanism should be established to collect and disseminate information on present and past practices in psychosurgery. (p.31)

In light of the ongoing psychosurgery controversy, the "non-reactive" nature (Webb, Campbell, Schwartz & Sechrest, 1970) of the present study, will hopefully contribute impartial and meaningful data towards an overall evaluation of the place of psychosurgery in contemporary society.

A Selective Review of the Development of Psychosurgery

The following account draws heavily on the historical overviews published by Fairman (1950), Greenblatt (1950), Kalinowsky & Hippius (1969), and Valenstein (1973).

Classically, psychosurgery refers to surgical operations on the frontal lobes of the brain for the purpose of altering behaviour in patients with no demonstrable brain disease. Chorover (1974) defines psychosurgery as:

> Brain surgery that has as its primary purpose the alteration of thoughts, social patterns, personality characteristics, emotional reactions, or some similar aspects of subjective experience in human beings. (p. 15)

Frequently appearing synonyms for psychosurgery are psychiatric surgery, mental surgery, sedative neurosurgery, psychiatric neurosurgery, behavioural neurosurgery, and functional neurosurgery. All of these terms allude to surgical intervention in the brain as a means of affecting behaviour.

The appellative psychosurgery and Chorover's definition will be used in the present paper. Leucotomy, which means the cutting of the white matter, is applied to a number of specific psychosurgical procedures, and is generally equivalent to the American term, lobotomy. Both terms refer to psychosurgical operations on the frontal lobes, and will be used interchangeably in this paper to preserve consistency with the older literature.

Antecedents of Modern Psychosurgery

The first precursor of psychosurgery can be traced back to the early trephining operations of ancient man. Fairman (1950) cites the absence of any signs of cranial trauma in the trephined skulls as evidence for the contention that these "operations" were a treatment for mental disorders. The earliest recorded modern psychosurgery was done by Gottlieb Burckhardt, a Swiss psychiatrist. On December 29, 1888, Burckhardt performed surgery on the intact brain of a psychotic patient to effect a reduction in assaultive behaviour. Burckhardt's efforts were influenced by the results of temporal lobe ablation in dogs, and evidence that hypertrophic changes in the temporal lobes were correlated with auditory hallucinations. Burckhardt believed that he could alleviate specific mental symptoms, which he felt were due to pathological changes in localized cerebral areas, by excising localized portions of cortex. Consequently, to reduce the auditory hallucinations and concomitant assaultive behaviour in his first patient, Burckhardt resected a strip of cortex in the left temporal lobe and adjacent sensory area. Over a period of one year, Burckhardt performed four consecutive operations to remove pieces of brain tissue, weighing up to 5.5 grams, from various

parts of the left hemisphere. Each operation was accompanied by some reduction in the disturbed behaviour of the patient. Only one of the seven psychotic patients eventually operated on by Burckhardt improved. One died post-operatively, and the remaining patients showed no improvement. These overall poor results forced Burckhardt to terminate his pioneering efforts. It is interesting to note that Burckhardt operated on the frontal lobes in only one of his cases, severing the fibres between the central area and the frontal lobes. This was the case which improved.

Lobotomies and Leucotomies — The Approbation of Psychosurgery

It was approximately fifty years after Burckhardt's first psychosurgical operation when Moniz and Lima performed the first "successful" psychosurgical operations. These operations provided the impetus for the tens of thousands of psychosurgical operations which followed. Encouraged by Fulton and Jacobsen's (1935) results with Becky and Lucy (two chimpanzees which had undergone bilateral ablation of the frontal association areas), and on the basis of Moniz's belief that pathological mental activity was due to dysfunctioning cell groups in the cortex, Moniz and Lima developed prefrontal "core" leucotomy. Moniz and Lima originally used injection of alcohol, and then later used a leucotome (i.e., a hollow knitting needle type device from which a thin wire loop could be protruded to cut the white matter) to destroy tissue in the frontal association areas. Moniz and Lima's technique resulted in the cutting of four to six cores, one centimeter in diameter, in the white matter of each hemisphere. The reported undesirable sequelae of their procedure consisted of incontinence, sluggish pupils, transient apathy, loss of initiative, disorientation, and inequality in the diameter of the pupils. These complications, together

with the lack of anatomical reference points which would allow a standardized procedure, resulted in limited use of this method by others.

Moniz's (1936) published results documenting a 35% recovery rate and a 70% improved rate for a series of 20 patients, prompted Freeman and Watts (1942) to perform the first psychosurgical operation in the United States in September 14, 1936. Freeman and Watts's first 20 cases were done according to Moniz and Lima's technique, but they soon developed a modification, the "precision" method, in response to relapses in their first patients and the lack of precision in using the Moniz technique. At about the same time Freeman and Watts became convinced that the cutting of the frontal thalamic connections was of major importance in producing the desired behavioural changes following psychosurgery. Consequently their precision method attacked these fibres. Using X-rays and skull landmarks Freeman and Watts inserted a blunt knife into bilateral burr holes, approximately in the region of the temple, and cut the fronto-thalamic connections with a sweeping motion in the coronal plane. Freeman and Watts classified their operations as minimal, standard, or radical, according to how far posteriorly the white matter was severed. Radical lobotomy was more likely to result in prolonged incontinence and convulsive seizures and was indicated for chronic cases, or cases which hadn't improved after standard or minimal lobotomy. Greenblatt (1950) states that minimal and standard lobotomies were used for affective disorders, while radical lobotomies were used for schizophrenic disorders. The wide scale adoption of lobotomy as a valid procedure in the treatment of intractable mental illness was primarily due to Freeman and Watts's unfailing devotion in their study of lobotomy and the publication of their monograph Psycho-

surgery (Freeman and Watts, 1942).

Modified Psychosurgical Operations — Approaching Specificity of Lesion and Effect

A dispute between neurosurgeons over the merits of "open" as opposed to "closed" operations, and the results of Mettler and Rowland's (1948) postmortem studies (which indicated that even the precision method resulted in significant variation in the point at which the leucotome entered the brain) paved the way for the modified leucotomies which followed. There were basically two types of modified leucotomies. One type was performed to arrive at the desired effect with the least possible destruction of brain tissue, and the other was performed in order that the neurosurgeon might have a better view of what he was cutting.

Lyerly (1938) developed the first open prefrontal lobotomy. The major importance of this techique was that it allowed separation of the subcortical white matter under direct vision, lessening the chances of hemorrhage and mortality due to accidental severing of an artery. Lyerly's technique consisted of a superior approach in which he approached the frontal thalamic-hypothalamic fibers and thereby cut them separately. This advance allowed Poppen (1948), the major exponent of Lyerly's open operation, to make his important contributions to the growing body of evidence indicating that severing the inferior medial (orbital) fibers alone could alter the emotional state without any gross blunting of intelligence. Fairman in 1950 stated that "the open technic, particularly in Poppen's operation, has reached the highest degree of precision and safety."

A great number of modified or partial leucotomies appear in the

literature. Partial lobotomies — upper and lower quadrant cuts (Freeman and Watts, 1942), inferior leucotomies (Dax, Reitman, & Radley-Smith, 1949; Egan, 1949; Freeman, 1949; Grantham, 1951; Hirose, 1965; Knight, 1964; Knight & Fredgold, 1955; McKenzie & Kaczanowski, 1964; Scoville, 1949; Tow & Lewin, 1953), cingulate operations (Ballantine, 1967; Foltz, 1962; LeBeau, 1954; Whitty, Duffield, Tow & Cairns, 1952), and various other operations (Penfield, 1948; Pool, 1949) were developed to maximize the benefits while reducing the side effects of psychosurgery.

Freeman's (1949) transorbital leucotomy was first developed by Fiamberti in Italy in 1932. This technique consisted of driving a leucotome through the orbital roof into inferior portions of the frontal lobes. The leucotome was then moved laterally and medially to sever the inferior frontothalamic connections. Due to its simplicity, this technique was often performed in the doctor's office. Kalinowsky & Hippius (1969) state that transorbital leucotomy almost surpassed standard lobotomy in terms of the number of operations performed and the therapeutic results. Transorbital lobotomy was abandoned primarily because it was a blind (closed) procedure, and because safer methods of operating on the base of the frontal lobes were developed. Scoville's selective cortical undercutting was one of these methods.

The advantages of Scoville's (1949) technique is that it combines the advantages of an open operation with the minimal damage of a more selective cut. Its other advantages are smaller openings in the skull and significantly shorter operating time. Essentially the technique consists of drilling two burr holes in the region of the temple, and using a spatula to lift the frontal lobes so that the orbital surface is exposed enough to allow the cortical grey matter to be detached from the

white matter. Scoville undercut three areas; the rostral portions of the cingulate gyrus, and the orbital and medial surfaces of the frontal lobes. The best results occurred with the orbital operation, although Scoville originally maintained that all three were effective.

Knight's (1960) restricted orbital undercutting and Hirose's (1965) orbito-ventromedial undercutting differ from Scoville's technique in that they are both more restricted procedures. Although both these procedures involve different loci in the region of the medial cortex, Kalinowsky & Hippius (1969) state that "both obtained the same favourable results."

A number of cortical, as opposed to subcortical (leucotomy) operations were also developed. Gyrectomy (removal of selected and limited parts of the frontal grey matter, usually following fissure lines in order to leave normally functioning gyri), topectomy (symmetrical removal of various specifically defined areas of the frontal grey matter), and cingulectomy (removal, bilaterally, of the anterior part of the cingulate gyrus), have all been performed with varying success rates.

Lobectomy (gross removal of sections of the lobes of the brain), a procedure primarily used in the treatment of tumours and epilepsy, did not prove to be particularly useful as a psychosurgical technique. Gyrectomy (Penfield, 1948) was abandoned because it did not prove to be better than lobotomy, and was marred by technical difficulties. Therapeutic results with topectomy (Pool, 1949) were related to the amount of cortex removed. Topectomy was discontinued because it was a difficult procedure, and because it had a high rate of postoperative epilepsy. Cingulectomy is still favoured today by Lewin (1973) as a treatment for purely obsessional illnesses.

The Renaissance of Psychosurgery

The separation of the frontothalamic fibres in the cortical white matter was usually the aim of most psychosurgical procedures. A number of operations (Andy, 1966; Balasubramaniam, Kanaka & Ramamurthi, 1970; Laitinen, 1972; Narabayashi & Shima, 1973; Sano, 1962; Vaernet & Modsen, 1970), using stereotaxic procedures, have been developed to circumvent surgery in the frontal lobes. Stereotaxic advances have also led to the development of more refined frontal lobe operations (Bringley, Leksell, Meyerson & Rylander, 1973; Knight, 1969, 1973; Meyer, McElhaney, Martin & McGraw, 1973).

These stereotaxic techniques, thalamotomy (Andy, 1966; Sano, 1962), amygdalotomy (Balasubramaniam et al, 1970; Hitchcock, Ashcroft, Cairns & Murray, 1973; Mark & Ervin, 1970; Narabayashi & Shima, 1973; Siegfried & Ben-Shmuel, 1973), hypothalamotomy (Balasubramaniam et al, 1970; Nadvornik, Pogady & Sramka, 1973; Sano, 1962), fornicotomy and upper mesencephalic reticulotomy (Sano, 1962), cingulotomy (Ballantine, Cassidy, Flanagan & Marino, 1967; Foltz & White, 1962 Meyer et al, 1973), tractotomy (Knight, 1973), and anterior capsulotomy (Bringley et al, 1973) generally produce extremely small lesions with significantly greater accuracy than the older psychosurgical methods. In contrast to the earlier psychosurgery which was primarily aimed at the treatment of chronically disabled psychiatric patients, these new techniques are primarily used in the treatment of relatively acute psychotic and neurotic patients as well as patients diagnosed under the general rubric "behaviour disorders." A representative list of the wide range of disorders contemporary psychosurgery is being

applied to is presented in Table 1.

Results and Indications of Frontal Lobe Psychosurgery

The gross, empirical, standard lobotomy of Freeman and Watts produced dramatic results, which help to explain the subsequent popularization of lobotomy. Psychiatric patients suffering from schizophrenic disorders, who for years had been chronically disturbed, became calmer and less of a management problem. The suffering of anxiety debilitated patients of all types was substantially reduced (Rylander, 1973). These relatively positive results were accompanied by the severe, undesirable sequelae of the well known "Frontal Syndrome." The immediate post-operative effects were usually apathy, disorientation, and clouded sensorium, while the more permanent effects were the disruption of abstract thought and foresight, emotional flattening, concomitant with a later tendency towards euphoria and a loss of initiative. The overall positive effect of psychosurgery is generally defined as "diminished reaction and vigilance of the brain to unpleasant sensations" (Kalinowsky, 1973). Unfortunately it is also generally conceded that this "diminished reaction" also applies to pleasant sensations. Therefore, in addition to reducing the concern over obsessions, hallucinations, delusions, etc., psychosurgery also tends to cause an overall decrease in drive and interest. The elucidation of these defects which accompanied standard lobotomy prompted psychosurgeons to try new and improved methods which would produce maximal benefit with minimal side effects.

Gyrectomies (Penfield, 1948), topectomies, (Pool, 1949), inferior, partial, and unilateral lobotomies (Freeman & Watts, 1942) were not as therapeutically effective as lobotomy, and were still accompanied by

Table 1

Disorders Treated by Contemporary Psychosurgery

Affective psychosis i)
Aggression g)
Aggressive behaviour & schizophrenia e), o)
Alcoholism k)
Anorexia nervosa f)
Anxiety f), g), h), i), k).
Debility l)
Depersonalization f)
Depression c), f), h), k), p)
Epilepsy l)
Epilepsy and behaviour disorders g)
Erethic idiocy i)
Idiocy l), n)
Imbecility l)
Intractable pain and depression i)
Obsessional f), h), p)
Obsessive-Compulsive d), g), i), k)
Obsessive-Compulsive and anxiety q)
Pain g), k)
Personality disorder f)
Psychopathy l)
Temporal lobe epilepsy i)

Behaviour disorders — Terminology

Abnormal aggressivity j)
Aggressive a)
Combative a)
Destructive a)
Explosive a)
Hyperactive a)
Hyperkinetic behaviour disturbance b)
Irritability n)
Poor concentration b)
Rage n)
Sadistic a)
Stereotyped movement n)
Violence j), m), n)

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a) Andy, 1966; b) Balasubramaniam, Kanaka & Ramamurthi, 1970; c) Corsellis & Alice, 1973; d) Hassler & Dieckmann, 1973; e) Hunter-Brown, 1973; f) Kelly, Richardson & Mitchell-Heggs, 1973; g) Kim & Umbach, 1973; h) Knight, 1973; i) Laitinen & Vilki, 1973; j) Mark & Ervin, 1970; k) Meyer, McElhaney, Martin & McGraw, 1973; l) Nadvornik, Pogady & Sramka, 1973; m) Narabayashi & Shima, 1973; n) Sano, 1962; o) Siegfried & Ben-Shmuel, 1973; Bridges & Goktepe, 1973; q) Bingley, Leksell, Meyerson & Rylander, 1973.

undesirable sequelae. Superior undercutting (Scoville, 1949) produced good results but interfered with intellectual functioning. Generally, only orbital and restricted orbital undercutting (Hirose, 1965; Knight, 1960; Scoville, 1949), cingulate operations (Livingston, 1953; Whittly, Duffield, Tow & Cairns, 1952), and bimedial leucotomies (Falconer and Schurr, 1959) produced good results with limited or slight undesirable side effects. These procedures produced fewer undesirable sequelae because they left part of the frontothalamic fibers intact (Kalinowsky, 1973). In sum, the overall results of psychosurgery are basically similar regardless of the locus of the operation within the frontal lobes. Only the relative balance between the desired and undesired sequelae appears to be related to the locus of the lesion. Generally, both the therapeutic effects and the side effects appear to be related to the quantity of brain tissue destroyed (Kalinowsky, 1973). However, the personality of the patient significantly interacts with the effects of psychosurgery (Kalinowsky, 1973; Kalinowsky & Hippius, 1969). Therefore, the response to psychosurgery depends greatly upon the patient's personality structure.

Anxiety, hypochondriasis, obsessions, tension, depression, agitation and numerous other neurotic symptoms have replaced schizophrenia as the primary indications for psychosurgery (Kalinowsky & Hippius, 1969) although psychosurgery may be indicated where these symptoms predominate in schizophrenia. The specific indications for frontal lobe psychosurgery in schizophrenia, affective disorders, psychoneurosis, hypochondriasis, drug addiction, alcoholism, psychopathic personality, mental deficiency, and epilepsy, have been reviewed by Kalinowsky & Hippius (1969) and

Scoville (1971) and will not be dealt with here. Indications for psychosurgery in the behaviour disorders are esoteric, but generally appear to be the inability of any other treatment to effect a positive outcome.

The Evaluation of the Efficacy of Psychosurgery — Previous Research

The following is a review of the variables and research strategies utilized in the evaluation of psychosurgery. No attempt will be made to review the multitudinous and often equivocal results of the many studies in the literature.

Independent Variables

The type of operation and the "type" of patient are the two primary independent variables in the psychosurgery literature. The results of psychosurgery are not always analyzed in terms of these variables, even though both variables are of necessity part of every study in this domain. However, some studies have specifically looked at diagnosis (Fleming & Baker, 1972; Freeman, 1961; Hetherington, Haden & Craig, 1972; Hirose, 1972; Knight, 1972; Kullberg, 1972; Lewin, 1973; Lindstrom, 1972; Lopez-Ibor & Burzaco, 1972; Scoville, 1972; Strom-Olsen & Carlisle, 1972), symptomatology regardless of diagnosis (Laitinen & Vilki, 1972), age (Freeman, 1961; Knight, 1972; Strom-Olsen & Carlisle, 1972), and the durations of illness and hospitalization prior to psychosurgery (Freeman, 1961; Lindstrom, 1972). Other less frequently investigated variables are response to E.C.T. (Freeman, 1961; Hetherington et al, 1972), premorbid personality (Hirose, 1972), general vs. mental hospital patient, race, sex, marital status, education, and occupation (Freeman, 1961). Some attempts have also been made to investigate the predictive efficiency of standardized preoperative ratings of social adjustment (Baker, Young, Gauld & Fleming, 1970; Fleming & Baker, 1972; Miller, 1954; 1967) and psychometric testing (Choppy, Zimbacca & LeBeau, 1973; Gachas,

LeBeau & Choppy, 1972) on outcome after psychosurgery.

Dependent Variables

Global, subjective, clinical ratings have almost exclusively been utilized to assess the outcome of psychosurgery. The ratings good, fair, poor (Mingrino & Schergna, 1972; Orthner, Muller & Roeder, 1972; Williams & Freeman, 1953), completely recovered, improved—no treatment necessary, improved—need some treatment, unchanged, worse (Bridges & Goktepe, 1973; Strom-Olsen & Carlisle, 1972), excellent, significant improvement, none (Brouger & Olesen, 1972), unchanged, improved, markedly improved, no treatment needed (Ballantine, Cassidy, Flanagan & Marino, 1972), well, marked, moderate, slight, none, and worse improvement (Meyer et al, 1973), and much improved, cured, unchanged (Whitty et al, 1952) have all been utilized to describe the results of psychosurgery.

Some authors have utilized more specific global assessments either alone or in combination with clinical ratings. For example, the ability to work and function in society and work ratings have been utilized in a number of studies (Freeman, 1961; Hetherington et al, 1972; Hirose, 1961; Holden, Peterson, Hofstatter & Olson, 1972; Lindstrom, 1972; Peterson, Doge, Sem-Jacobsen, Lazarte & Homan, 1955; Strom-Olsen & Carlisle, 1972). Ratings of personality defects and relief of symptomatology (Hetherington et al, 1972; Knight, 1972; Lindstrom, 1972), discharge and readmission rates (Freeman, 1961; Hetherington et al, 1972; Hirose, 1961; Holden et al, 1972; Lopez-Ibor & Burzaco, 1972; Williams & Freeman, 1953), and number of months in hospital after surgery (Hetherington et al, 1972) are also widely cited in the literature. Objective, operationally defined rating scales (Baker et al, 1970; Boyd, Weber & McKenzie, 1958; Fleming & Baker, 1972; Miller, 1954; 1967) and psychometric test scores (Gaches et al, 1972; Hamlin, 1970;

Hitchcock et al, 1973; Laitinen & Vilki, 1972; 1973; Meyer et al, 1973; Rylander, 1948) have also been used. The variation in the descriptive information accompanying the clinical and work ratings makes comparisons between studies meaningless. Only studies utilizing operationally defined rating scales, psychometric test scores, and discharge and readmission rates, etc., provide useful, quantitative data which allow comparisons between studies.

Controlled Studies

There have been a relatively small number of studies which have attempted to carry out controlled studies of the effects of psychosurgery. Robin (1958) has reviewed studies carried out up until 1956, and has found many of them lacking adequate matching of the treatment and control groups or suffering from too short a follow-up. The conclusions of these studies were generally equivocal. However, one of these studies (Livingston, 1953) deserves special mention. This is probably the only study in the literature which has utilized sham-operated patients. Livingston finds evidence in his study for the positive effect of the surgery per se, with the treatment group improving more than the sham-operated controls. These results are tempered by the short period of follow-up and the non-equivalence of the two groups.

Robin (1958) compared leucotomy patients and controls matched for chronicity, age on admission, sex, and length of treatment, and found no significant differences between the treatment and control groups on a number of outcome measures. However, Robin did not attempt to match his groups on diagnoses. McKenzie and Kaczanowski (1964) also found no differences between their leucotomy and control subjects matched on overall prognosis, tendency to spontaneous remission, period and place of hospitalization, and

length of follow-up. This study utilized group-wise matching and did not attempt to match for diagnoses. Also, McKenzie and Kaczanowski used a very short period of follow-up (5 years). Other controlled studies (Marks, Birley & Gelder, 1966; Tan, Marks & Marset, 1971) have reported favourable results for the treatment groups as compared to the controls. Different proportions of the treatment groups in these latter two studies were not adequately matched.

Conclusions — Problems in Evaluation of Previous Research

The psychosurgery literature is overrun by studies using widely different criteria for success (many of them subjective), different surgical procedures, and varying subject populations. Most of these studies are also limited in the extent and clarity of the descriptions of pertinent variables necessary for the evaluation of psychosurgery. Consequently, the results of the tens of thousands of psychosurgical operations are practically impossible to evaluate, and at best one can only say the results are equivocal. Valenstein states:

> The problem of evaluation is extremely difficult since the "evidence" often consists of the subjective impressions of those who cannot help but be concerned about the correctness of their decisions to undertake psychosurgery as well as often being ego-involved in establishing the success of the particular surgical method employed. This is not to imply that the results have been consciously distorted, but in the absence of objective criteria and adequate experimental controls, it is very easy to find improvement when one looks for it, and to attribute it to the particular psychosurgical procedure used. The amount of post-operative improvement that should be attributed to changes in the attitude and expectancy of the hospital, staff, relatives, and the patient, is usually impossible to determine. (p. 296)

Studies which utilize primarily objective criteria, and which are temporally and emotionally removed from data, are necessary for an impartial and thorough evaluation of past psychosurgical practices. The present study is addressed

to these issues, and will hopefully provide an impetus for the careful, objective evaluation of past and especially present psychosurgical problems. The demotion of purely subjective, "reactive" psychosurgical research is overdue.

The Research Plan of the Present Study

The study of psychosurgery does not lend itself to the experimental control possible in either animal studies or studies of nonevasive procedures in humans. Consequently, any study of psychosurgery is hampered by the generally unknown effects and interactions of numerous variables which are not easily controlled. Thus the effects of psychosurgery are complex and cannot be explained by a strictly clinical, subjective approach or analysis of single variables in isolation. There is an overall paucity of the use of objective data and statistical analyses in the psychosurgery literature. The present research utilizes, for the most part, objective measures and statistical techniques to study the multiple influences of a number of variables on the outcome of psychosurgery.

The ex post facto nature of the present research severely limits the data available for analysis; however, sufficient data exists to make strong statements as to the efficacy of psychosurgery to reduce the period of hospitalization and to return the patient, in at least a semiautonomous role, to the community.

A number of issues raised by Robin (1958) must be considered in the evaluation of the therapeutic effects of psychosurgery: (i) "spontaneous remission" may be as high as 50% in large groups of psychotics; (ii) successful outcome in psychosurgery may be confounded by deriving indications for surgery from improved cases and thereby selecting only those patients

with good prognosis; (iii) patients treated decades apart may not be comparable due to the possible changes in the nature and treatment of functional psychosis; (iv) acute and chronic patients are not comparable with respect to prognosis; and (v) a number of factors not related directly to the psychosurgery (attitudes of the community, differential rehabilitative treatment after surgery, and ego involvement in the effectiveness of the treatment) may spuriously inflate the success attributable to the psychosurgery per se. In order to address these issues, the present research employs a control group treated during the same time period, under essentially the same conditions, and having the same general prognostic indicators as the treatment group. These equivalences between the control and treatment groups would, presumably, insure that equal numbers of both groups would improve under similar conditions. In addition a sufficiently long follow-up is utilized to control for the "flash in the pan" effects of any extraordinary treatment and any social aspects (e.g., self-fulfilling prophecy) of recovery.

The methodological problems confronting this research are to select the most important and workable factors affecting prognosis and then match the control and leucotomy groups accordingly. As much as possible, these factors must be objective and not subject to biases extending from the knowledge of the leucotomy-nonleucotomy status of the patient.

The variables matched in this study are: (i) age on first admission; (ii) sex; (iii) diagnosis; and (iv) chronicity. These measures are readily obtainable from the case records and do not require any interpretation. Sex, chronicity (Sykes & Tredgold, 1964), age on admission (Post, Rees, & Schurr, 1968; Sargant, 1962), and diagnosis (Freeman, 1971; Scoville, 1972) have all been implicated in prognosis.

Variables

All data are obtained from either the official medical records or the private records of a psychiatrist closely involved with the leucotomy clinic for a number of years. Where possible, equivalent data was collected for both the control and leucotomy groups. The data falls into two classifications, objective-quantitative and subjective-qualitative. All of the objective data and some of the subjective data come directly from the archival records and therefore no interpretation or judgement is required on the part of the researcher. However, other subjective data are inferred and synthesized from the nursing and psychiatric notes contained in the medical records. For the most part, these latter data are used strictly for descriptive purposes and do not enter into any statistical analyses. Also, a significant proportion of the data compiled is not subjected to analysis in the present study and conseqently will not be described here.

The variables utilized in the present research are described below. The pre/post leucotomy periods for the control group are the same as for the matched leucotomy group.

Chronicity is the time from the first recorded admission to a mental health facility until the date of psychosurgery. (Chronicity is matched for the control and leucotomy patients. In order to filfill the chronicity criterion, the control patients will have had to be admitted to hospital at about the same time as the matched leucotomy patients and will have had to be in hospital at the time of psychosurgery. Better equivalence of the two groups would have been obtained from matching the time from first admission until psychosurgery excluding any time spent discharged from hospital. This more stringent criterion would have made matching all but impossible and was therefore not adopted. However, the time spent in hospital was recorded for

both groups and was considered in the analyses.)

Total history of psychiatric illness is the time from first admission until last recorded discharge.

Total period of psychiatric illness is the time actually spent as a psychiatric patient from first admission until last discharge. This includes time spent on "probation" and excludes time between discharge and readmissions.

Total period of hospitalization prior to psychosurgery is the time actually spent in hospital from first admission until psychosurgery.

Total present period of psychiatric illness is the time since the admission immediately prior to leucotomy until last recorded discharge. The same qualifications as for total period of psychiatric illness apply here.

Present admission time is the length of the present admission until psychosurgery.

Discharge time is the time from psychosurgery until first discharge.

First readmission time is the time from first discharge after psychosurgery until first readmission.

Total period readmissions is the time spent admitted to hospital during all readmissions following psychosurgery.

Admissions is the total number of admissions. These data are broken down into pre- and post-leucotomy periods.

Psychosurgery measures are the date of psychosurgery, age at psychosurgery, and the type of present psychosurgery (e.g., unilateral left, unilateral right, bilateral, etc.).

Diagnostic measures are the diagnosis at first recorded admission, the diagnosis at present admission, and any change in diagnosis after psychosurgery. Time after surgery until change in diagnosis was also recorded.

Age measures are age at first admission, age at psychosurgery, and age at death.

Treatments include the exact recorded number of ECT, insulin coma, and metrazol coma treatments. Treatments are broken down for the pre- and post-leucotomy periods.

Leucotomy scale ratings are the ratings on a 100-point scale of social adjustment recorded prior to psychosurgery and six months, one, two, three, four, and five years after leucotomy. The ratings are available only for the leucotomy group. (A copy of the leucotomy scale is included in Appendix A.)

Present status is the level of social adaptation at last recorded contact, measured by type of placement. The mutually exclusive and exhaustive categories of the variable are as follows: (1) in psychiatric hospital, (2) in a closely supervised environment (e.g., nursing home), (3) in a sheltered environment (e.g., half-way house), (4) outpatient, (5) at home, and (6) dead.

Demographics recorded are sex, date of birth, marital status, number of offspring, history of familial psychopathology, place of birth, nationality, economic status, religion, attained grade level, urban or rural environment, employment before first admission, and history of epilepsy.

Economic status is categorized as follows: (1) indigent (lacking any means of subsistence), (2) dependent (receiving aid from public funds, persons outside the immediate family, or the family), (3) marginal (living on earnings but having accumulated little or nothing), (4) borderline (living on earnings with some limited accumulated resources, (5) comfortable (accumulated resources sufficient to maintain self and family for at least four months), (6) unknown.

Employment was broken down into the following categories: (1) professionals, (2) proprietors, managers, and officials, (3) artisans, (4) clerks, salespeople, and kindred, (5) skilled workers and foremen, (6) semiskilled workers, (7) farmers and farm workers, (8) unskilled workers (nonfarm), (9) student, and (10) no occupation.

Data Collation

Three major data comparisons are made in the present research. The first set of analyses assess the group-wise equivalency of a group of randomly selected leucotomy patients and the remaining leucotomy patients, and the second set of analyses attempt to discriminate the matched control from the randomly selected leucotomy patients. The third set of analyses is concerned with elucidating the factors which led to effective psychosurgery. In a fourth set of analyses, a group of patients rejected for leucotomy is compared to the leucotomy group. A number of the variables described above, or transformations of these variables, are used in these analyses. Analyses-related specifics will be described in the next chapter.

In sum, the present research takes a tack which is different from most, if not all, studies in the literature. Most research on frontal-lobe psychosurgery is based on partial samplings of patients. The present study examines an entire leucotomy clinic, together with a rejected-for-leucotomy group and an appropriate control group, and utilizes a relatively long follow-up. A deferred-for-leucotomy group may be examined in future research with this data-base. All the data analyzed in the present research are primarily objective and are not subject to biases on the part of the researcher. Overall, the aim of the present study is to assess the efficacy of psychiatric prefrontal leucotomy to effect a reduction in psychiatric

hospitalizations and in addition, to identify some factors which influence the outcome of psychosurgery.

CHAPTER 2

METHOD

Subjects

Background

In June, 1952 a leucotomy programme was begun at the Ontario Hospital (now Hamilton Psychiatric Hospital) in Hamilton, Ontario. The initial focus of this programme was an attempt to reduce the arduous problems of ward management in a chronic, highly disturbed population of psychiatrically ill patients. The Hamilton Psychiatric Hospital in the 1950's was typical of large mental hospitals of that era. The population was large and diverse, and the staff-patient ratio was very low. Available resources and community supports were minimal, thereby making treatment a largely unattainable objective. Diagnosis, the selection of problems which could be handled by known methods, and custodial care were the primary foci of the psychiatric intervention.

The Psychosurgery Group

As a group, the patients selected for prefrontal leucotomy were characteristically destructive, noisy, and on occasion assaultive, and they often required supervision in their eating and hygienic habits (Boyd, Weber, McKenzie, 1958). The psychosurgery was not undertaken precipitously. None of the leucotomy group had shown lasting symptomatic improvement following exhaustive application of a number of other treatments. The patients selected for the psychosurgery were each the subject of a leucotomy conference, attended by psychiatrists and members of the psychology and nursing staff, where their case history was reviewed and carefully considered before the final decision to perform leucotomy was made. The leucotomy patients had

all been referred for psychosurgery by either the psychiatrist in charge of their care or their families. In some instances, the patients themselves had requested the psychosurgery.

Early clinical evaluation of the Leucotomy programme led to an extention of the aims for this group beyond a reduction in the problems of hospital care, to an attempt to return these patients to the community (Boyd et al., 1958).

The psychosurgery group comprises 377 patients of the whole series of 406 patients who had undergone prefrontal leucotomy between 1952 and 1967. Figure 1 presents the yearly incidence of the psychosurgeries. Twenty-nine of the overall series were lost to follow-up. These include 20 patients whose records had accompanied them when they were transferred to other Psychiatric Hospitals. The records for the other nine patients were unlocatable at the time of follow-up.

The leucotomy group consisted of 140 males and 237 females. Their mean age at psychosurgery was 41 years (range, 16.41 to 70.00 years); over 98% were Caucasian. Their mean grade level was 8.63 and ranged from no formal schooling to 5 years post-secondary school education. Most (99%) were from the lower socioeconomic classes. The breakdown of diagnostic categories at the time of psychosurgery is presented in Table 2. The chronic nature of the leucotomy patients' illnesses at the time of psychosurgery is forcibly illustrated by a mean duration of illness and a mean period of hospitalization of 9.98 and 7.05 years respectively.

The Control Group

The control group consists of 100 Psychiatric Hospital patients selected to match 100 randomly chosen leucotomized patients available to

Figure 1

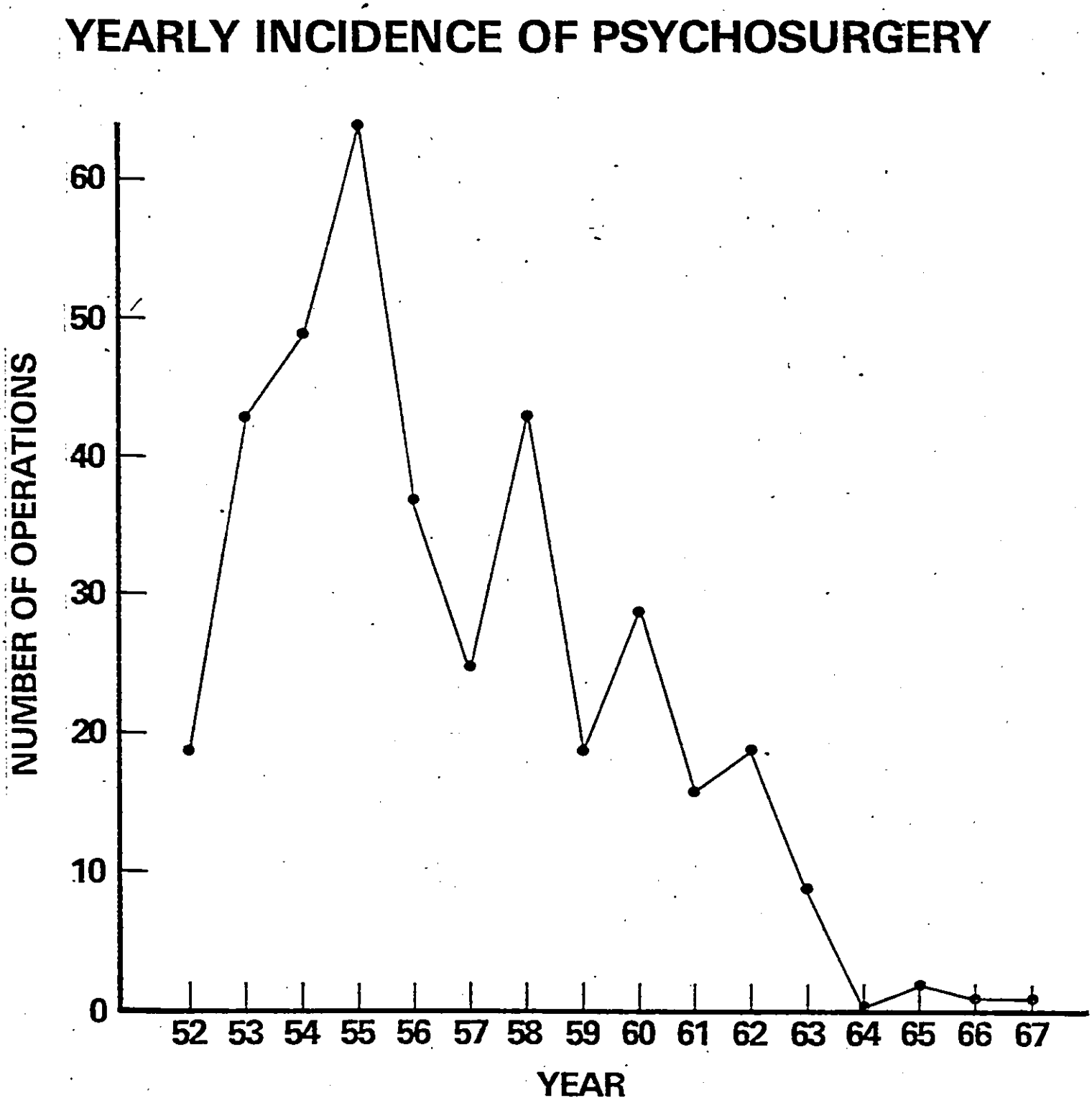

YEARLY INCIDENCE OF PSYCHOSURGERY
NUMBER OF OPERATIONS
0
10
20
30
40
50
60
52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67
YEAR

TABLE 2

Diagnostic Categories at Psychosurgery for the (Combined) Leucotomy Group

Diagnosis	N
Schizophrenia	
Simple	9
Hebephrenic	11
Catatonic	149
Paranoid	103
Schizo-affective	5
Undifferentiated	12
Total	289
Affective Disorders	
Manic-depressive psychosis	37
Involutional depression	3
Other	6
Total	46
Paranoid States	
Involutional	2
Other	5
Total	7
Psychoneurosis	
Obsessive-compulsive	5
Neurotic depression	5
Other	11
Total	21
Unspecified Psychoses	5
Other	9

follow-up. The two groups are pair-wise matched on sex, age, diagnosis, and chronicity (i.e., matched on length of psychiatric history from first admission until date of psychosurgery). The controls were selected haphazardly from the alphabetically listed statistical files at Hamilton Psychiatric Hospital.

Each of the selected leucotomy patients was matched with a control of the same sex, of approximately the same age (plus or minus 6 years), and of the same diagnosis at first or subsequent admissions. All controls were admitted (first admission) at approximately the same time (plus or minus 6 years) as the paired leucotomy patients and were within the hospital system at the time of psychosurgery.

Where diagnosis could not be matched exactly, patients were matched on general nosological categories; only if such a patient was not available, was a control from another nosological category selected. This latter situation occurred in only nine cases; in five of these cases the primary symptomatology (e.g., depression, paranoia) was matched for the two groups. All nine cases were adequately matched on the other variables. Where year of admission could not be matched within the set range, a control was chosen who matched the leucotomy patient on age and diagnosis, and whose first admission date was no greater than 10 years different from the matched leucotomy patient. Only 11 cases could not be matched within the six year range: seven pairs were seven years apart; three were eight years apart; and the remaining pair were nine years apart. In sum, the order of importance in matching was first sex, then age, followed by diagnosis and chronicity. Table 3 summarizes the pertinent information for these two groups and outlines clearly the adequacy of the control-leucotomy matching.

TABLE 3

Characteristics of Random Leucotomy and Control Groups on Matched Variables

Variable		Random Leucotomy	Control
Sex			
	Male	33	33
	Female	67	67
Mean Age at Psychosurgery		39.70 yrs.	39.40 yrs.
Mean Chronicity		8.86 yrs.	8.20 yrs.
Diagnosis[a]		N	N
	Schizophrenia	78	83
	Affective Disorders	10	7
	Paranoid States	4	1
	Psychoneurosis	6	8
	Other	2	1
	Total	100	100

[a] This breakdown does not reflect internosological matching (e.g., Paranoid Schizophrenia to Paraniod State).

The Rejected-for-Leucotomy Group

The Rejected-for-Leucotomy group consisted of 16 patients (9 males and 7 females) who had been considered for leucotomy and were subsequently rejected for the surgery because of medical, legal, or clinical reasons. Their mean age at first admission was 34.32 years (range, 17.55 to 67.82 years), and their attained grade level ranged from 3 years to 3 years post-secondary education. Table 4 presents the breakdown for this group of general nosological categories at time of first admission.

TABLE 4

Diagnostic Categories for the Rejected-for-Leucotomy Group

Diagnosis	N
Schizophrenias	10
Affective Disorders	3
Neuroses	1
Other	2

Neurosurgical technique

Boyd et al. (1958) have described the inferior prefrontal leucotomy utilized in the present psychosurgery as follows:

> A comparable standard technique has been carried out on all patients, utilizing a leucotome ... devised to make a cut through the white matter of the frontal lobes 4 to 5 cms. in diameter. A burr hole is made about one inch from the midline on each side. From before backwards the burr hole is directly over the surgeon's imaginary visualization of the posterior margins of the supra orbital plates and just in front of the anterior horns of the lateral ventricles. After the

> dura is opened, a small area of corter is coagulated and punctured. A brain needle is then inserted and the central portion of the posterior margin of the supra orbital plate is palpated. The needle is withdrawn and the unopened leucotome is inserted along the same line and brought to rest impinging on the posterior margin of the supra orbital plate. The plunger of the leucotome is then depressed and the wire loop is extruded, making a cut 4-5 cm. in diameter in the white matter of the frontal lobes .... The plunger is withdrawn, pulling the wire back into the instrument, which is then withdrawn through the small cortical puncture wound. Finally, using a brain needle which gives a surgeon a sense of feel the intra-cerebral cut is enlarged medially - during this procedure the falx can be palpated and often the end of the blunt brain needle can be felt slipping over the anterior cerebral artery. The dural openings are covered with a piece of polyethylene membrane and the burr holes filled with bone dust to prevent a deforming depression.
>
> As one gains experience with this technique, it is fair to assume that most of the cuts are symmetrically placed just in front of the anterior horns of the ventricles and they do not extend down into the dangerous third ventricle region. We have had an occasional major hemorrhage and a mortality rate from this cause of approximately 1%, caused we feel by attempting to enlarge the cut by manipulation of the leucotome after it is opened. There have been no major hemorrhages since we have stopped this and used a brain needle to enlarge the mesial parts of the leucotomy cut.
>
> We have considered it advisable to make a smaller cut in certain patients; this is accomplished with a leucotome which extrudes the wire only from one side. (Boyd et al., 1958, p 171-173).

The psychosurgery, except in cases of operative complication, was completed in 20 to 30 minutes. All the psychosurgery, except the last two operations in the series, was done by the same neurosurgeon. The majority of the patients were up within a day, and were returned to their prepsychosurgery ward after about a week.

Table 5 presents the breakdown of the surgery performed in the present sample. Approximately 90% of the 377 leucotomized patients available to follow-up had received the standard, bilateral prefrontal leucotomy. Roughly 4% of the population received either unilateral or modified leucotomy. The type of operation for these latter cases was determined, for the most part, preoperatively, but on occasion operative complications determined the unilateral operation. Operative records were unobtainable for approximately

TABLE 5

Breakdown of Operative Variations

Type of Psychosurgery	N
Unknown	25
Standard Bilateral	340
Standard Bilateral (one loop)	1
Unilateral Right	1
Unilateral Left	5
Right Frontal Lobectomy	5

6% of the population. A 2.9% mortality rate and a 5.8% incidence of epilepsy were associated with the psychosurgery in the 377 patients available to follow-up.

Data Source and Follow-up

All of the data utilized in the present study has already been described. The data was recorded directly onto a computer coding sheet from both the medical records and the records of the psychiatrist in charge of the leucotomy programme. The data source is organized and completely legible, but in some cases is not entirely complete. In those instances, incomplete information is simply recorded as missing data.

Numerous precautions were taken to insure the accuracy of the original coding and its transformation into machine readable form. An extremely

detailed "code book" was utilized throughout the data gathering and analyses stages of the present research. Considerable effort was expended to insure mutually exclusive and exhaustive coding categories. The reliability of the original coding was assessed by recoding 20 randomly selected cases. No differences for the variables used in the present research were found upon comparison of the original and reliability codings. All the coding sheets were edited for legibility and completeness and were then submitted for professional keypunching and verifying. The punched data was then recorded on magnetic tape.

The Statistical Package for the Social Sciences (SPSSH - Release 6.02) was used to build, edit, document, and analyze the system file utilized in this research. Extensive file editing insured that undefined or spurious codes were not present during the data analysis. Also, randomly selected cases from the system file were compared to the original coding sheets and were found to be identical for all untransformed variables. Hand calculations from the coding sheets provided results identical to the computer generated transformations.

It may not be entirely defensible in all cases to rely upon this data source when patients have left hospital and never returned. It is assumed, however, that hospitalization in other institutions would result in some contact with Hamilton Psychiatric Hospital and therefore be recorded in the case records. In these situations, important readmission data will not be readily available and may result in the reduction of the period of follow-up. However, it is expected that in most of the cases patients would return to or come in contact with Hamilton Psychiatric Hospital should they require further hospitalization or treatment and therefore a drastic reduction in

the period of follow-up is not expected.

The period of follow-up for this study extends from the date of leucotomy until the date of data recording. Thus the periods of follow-up in this study range between 9 and 24 years.

A salient advantage in utilizing the present data source is that it is readily accessible and is economical in terms of both time and financial considerations compared to other possible methods of follow-up. Also, the present approach circumvents the ethical problems inherent in a more direct follow-up technique. The present form of follow-up is carried out with full realization that better and more accurate follow-up procedures are possible.

Data Analysis

Leucotomy-Random Leucotomy Comparisons

The 100 randomly selected leucotomy patients and the remaining 277 leucotomy patients were compared statistically. The primary statistical tools for the analyses involved crosstabulation analysis (chi-square) and group mean comparisons (*t*-tests). Two-tailed tests of significance were used in all analyses. Table 6 lists the previously described variables utilized in the Leucotomy-Random Leucotomy analysis.

Random Leucotomy-Control Comparisons

Crosstabulations and *t*-tests were utilized to attempt to discriminate the control and random Leucotomy groups. The variables listed in Table 6, with the exception of type of operation, were used in these comparisons.

Successful-Unsuccessful Leucotomy Comparisons

In order to elucidate the factors which led to effective psychosurgery, a group of 71 "successful" leucotomized patients were compared to the re-

TABLE 6

Variables Utilized in the Leucotomy–Random Leucotomy Comparisons

Variable Type	Variable
Categorical	Sex
	Marital status
	Place of birth
	Nationality
	Economic status
	Occupation
	Rural–urban environment
	Present status
	History of epilepsy
	General diagnostic categories at first admission
	General diagnostic categories at psychosurgery
	Type of psychosurgery
	Death
Ratio	Birthdate
	Date of first admission
	Age at first admission
	Age at psychosurgery
	Total history of psychiatric illness
	Total period of psychiatric illness
	Chronicity
	Length of hospitalizations prepsychosurgery
	Date of death
	Grade attained
	Incidence of familial psychopathology
	ECT treatments pre/post psychosurgery
	Insulin coma treatments pre/post psychosurgery
	Metrazol coma treatments pre/post psychosurgery
	Admissions pre/post psychosurgery
	Discharge time
	First readmission time
	Total period of readmissions

maining largely "unsuccessful" group. The successful group was selected very conservatively according to the following criteria: 1) they were alive and well, and were not in hospital or nursing homes, 2) they had not been readmitted to a psychiatric facility after postoperative discharge, and 3) where the data were not missing (N=25), had attained no less than a mean Leucotomy Scale rating of 50 over at least 4 years postpsychosurgery; that is, as a group, the successful leucotomies with data available on this measure had made a significant gain in level of adaptation to the point that they could function, at least semi-autonomously, in the community. The analyses and variables described in the Leucotomy-Random Leucotomy comparisons were used to compare the 71 successful and 306 unsuccessful leucotomy patients.

Leucotomy-Rejected Leucotomy Comparisons

The 16 rejected-for-leucotomy patients and the 377 leucotomy patients were compared statistically with the previously mentioned analyses. The variables used in this set of group comparisons are essentially the same as those used in the Random-Control comparisons. This was accomplished by defining the date on which psychosurgery was rejected as the "date of psychsurgery". This date was then utilized in the computation of pre- and post-psychosurgery measures for the rejected-for-leucotomy group.

CHAPTER 3

RESULTS

Tables containing number of subjects, means, standard deviations, t-ratios, chi-squares, and significance levels for the main comparisons are included in the appendix.

Leucotomy-Random Leucotomy Comparisons

There were no systematic differences indicated in the comparisons of the Leucotomy and Random Leucotomy groups. These groups could not be differentiated on numerous demographic variables, diagnoses, history of psychiatric illness, and period and number of hospitalizations before and after psychosurgery. Also they did not differ in the number of electro-convulsive (ECT), insulin coma, and metrazol coma treatments before and after leucotomy. However, the Random Leucotomy group was first admitted to hospital approximately 2.06 years later (t (375) = -1.96, $p < .05$) than the Leucotomy group and had attained a greater level of education (t (365) = -2.39, $p < .017$).

Random Leucotomy-Control Comparisons

There were no systematic differences between the randomly selected leucotomy and control groups. There were no significant age, diagnostic category, ethnic, religious, or socioeconomic differences between the two groups. There were no differences in incidence of familial psychopathology or epilepsy prior to the surgery. The leucotomy and control groups did not differ in terms of total chronicity, total period of hospitalization, or chronicity and hospitalization periods before and after psychosurgery. The leucotomy group received significantly more electroconvulsive treatments (t (112.39) = 3.83, $p < .0001$) and were hospitalized more (t (172.51) =

2.23, $p < .027$) prior to the surgery. The controls received significantly more insulin coma treatments (t (195) = -2.06, $p < .041$) after the surgery. There were no significant differences in the number of administered ECT treatments after psychosurgery. There were fewer hospitalizations (t (185.97) = 1.98, $p < .049$) for the leucotomy group vis-a-vis the control group after psychosurgery. The leucotomy patients readmitted to hospital after post-psychosurgery discharge remained hospitalized significantly longer than the readmitted controls (t (57.37) = 2.06, $p < .044$). The two groups did not differ in the number of discharges after surgery, nor did they differ in terms of their status at the time of follow-up. Sixty-one percent of the leucotomy group and 54% of the controls were out of hospital, and 27% and 29% of the leucotomy and control groups, respectively, were in hospital or nursing homes. On the basis of this, readmission rates after psychosurgery were considered similar for both groups. Death rates and age at death were also similar for both groups. The Random Leucotomy group had attained a higher mean grade level (t (196) = 2.58, $p < .011$) than the controls (9.21 for the random leucotomy group and 8.16 for the controls).

Leucotomy-Rejected Leucotomy Comparisons

There were no meaningful differences between the rejected group and the combined group of 377 leucotomy patients.

Successful-Unsuccessful Leucotomy Comparisons

The successful leucotomies had significantly shorter total periods of illness (t (131.89) = -11.60, $p < .0001$) and hospitalization (t (221.61) = -14.09, $p < .0001$) than the unsuccessful leucotomies. The successful leucotomies also received significantly fewer ECTs (t (310.15) = -4.35, $p < .0001$) after psychosurgery. A greater proportion ($\chi^2(1) = 6.20$, $p < .020$) of the successful patients were married and also, a greater proportion of this group ($\chi^2(5) = 13.09$, $p < .023$) were at a higher economic level. The

successful leucotomies had been admitted to hospital later (t (375) = 4.31, $p < .0001$) and at an older age (t (370) = 2.41, $p < .017$). These patients also had a significantly shorter chronicity (t (374) = -3.17, $p < .002$) and period of hospitalization (t (233.78) = -8.43, $p < .0001$) prior to the psychosurgery. A very salient difference between the successful and unsuccessful groups was the proportion of schizophrenias and affective disorders represented in the two groups at time of psychosurgery (χ^2 (1) = 11.70, $p < .001$); 37% of the affective disorders and 15% of the schizophrenias were represented in the successful group.

CHAPTER 4

DISCUSSION

On the basis of the lack of systematic differences between the 100 randomly selected leucotomy patients and the remaining 277 leucotomy patients, the Random Leucotomy group can be considered to be representative of the Leucotomy group as a whole. Conclusions drawn from the comparisons of the randomly selected leucotomy patients and the control group are applicable to the entire leucotomy group (N = 377). Given the number of group comparisons made, the leucotomy-random leucotomy differences are likely a function of chance.

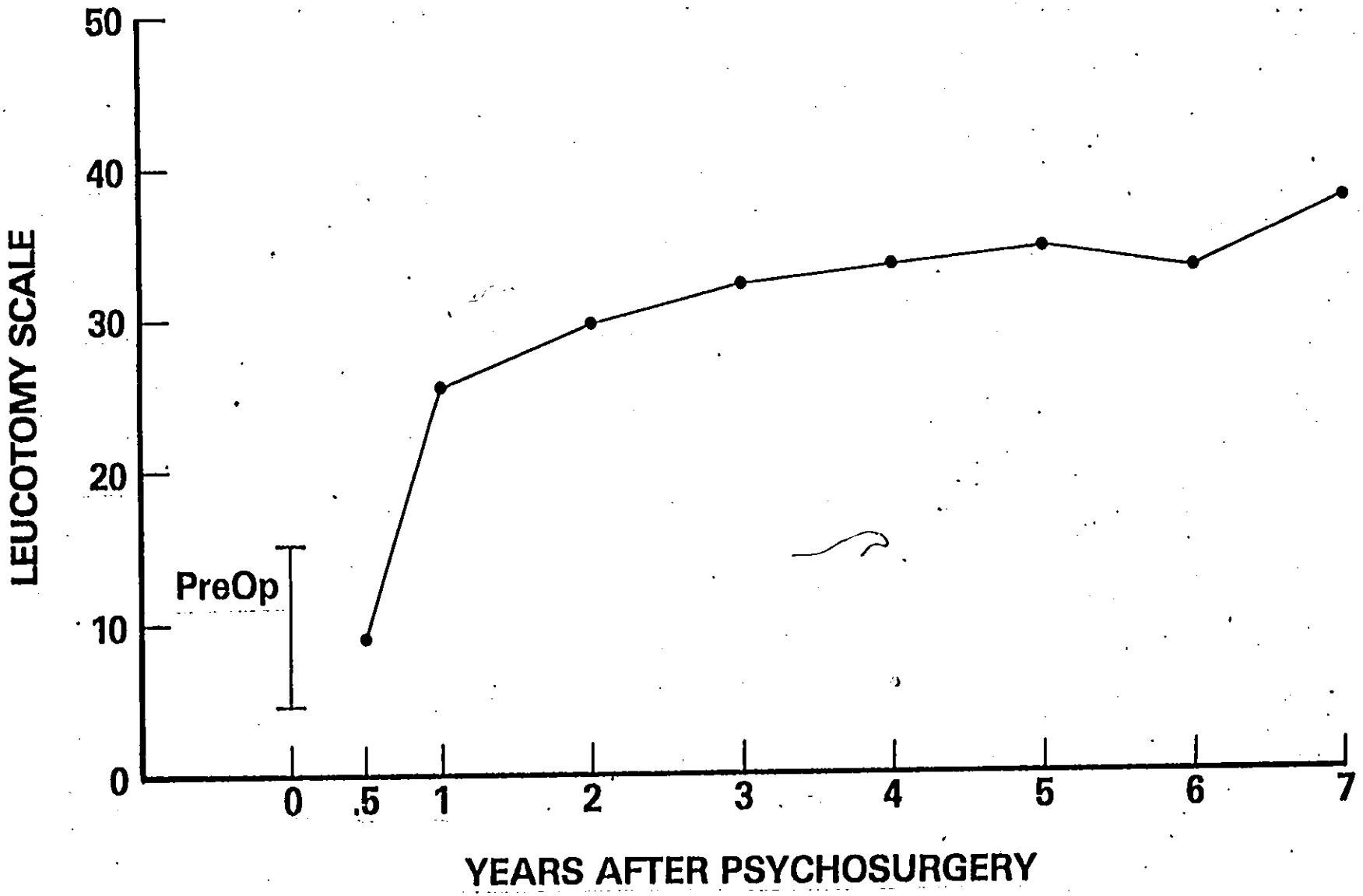
The Random Leucotomy and Control group comparisons suggest that the criteria for selection for psychosurgery were not based on particular ethnic, religious, or socioeconomic grounds. Likewise, there was no evidence to suggest that the psychosurgery was employed punitively. Prefrontal leucotomy, as performed under the conditions outlined in this paper, was not associated with an increased death rate, or improved or accelerated discharge rates; nor were decreased or delayed readmission rates concomitants of the psychosurgery. Overall, the data do not support the contention that prefrontal psychosurgery is effective generally in the treatment of psychiatric disease; that is, in a chronic, mixed hospital population. These findings are consistent with previous retrospective studies utilizing comparison groups (McKenzie & Kaczanowski, 1964; Robin, 1958).

At this juncture, a brief discussion of the issues surrounding the choice of appropriate controls in psychosurgery research is warranted. Clearly, the most ideal control group would be a subgroup of to-be-

leucotomized patients randomly assigned to a sham operations condition. The ethical and practical limitations of such a selection procedure are obvious and do not need to be discussed here. The next best control would be one matched closely to a leucotomy group on severity of illness, diagnosis, prior treatment, age, sex, and period of hospitalization. In the present study, 100 controls were adequately matched on all of these variables except severity of illness and prior treatment. Matching the leucotomy and control groups on these variables, given the data source, was not feasible. The fact that these two groups did not differ in the number of insulin and metrazol coma treatments prior to psychosurgery argues for some equivalence on the treatment dimension; however, the clearly significant difference in the ECT treatments for the two groups mitigates against this. The unequivalence of the treatment dimension, together with the undeniable fact that the leucotomy group underwent psychosurgery indicates that the leucotomy and control groups cannot be considered equivalent in terms of severity of illness. Perhaps then, this is where the rejected-for-leucotomy patients are most valuable. These patients had been recommended for leucotomy and therefore can be considered to be equivalent to the leucotomy group on the severity of illness dimension. Despite the small number of cases in this group, the rejected-for-leucotomy and combined leucotomy comparisons support the contention that the psychosurgery was not group-wise effective in treating and returning to community those patients selected for the operation. Inspection of the mean Leucotomy Scale ratings for the leucotomy patients is helpful in reconciling the frequently cited beneficial, clinical effects of psychosurgery with these results. Figure 2 presents the range of the mean

Figure 2

MEAN LEUCOTOMY SCALE BY YEARS AFTER PSYCHOSURGERY

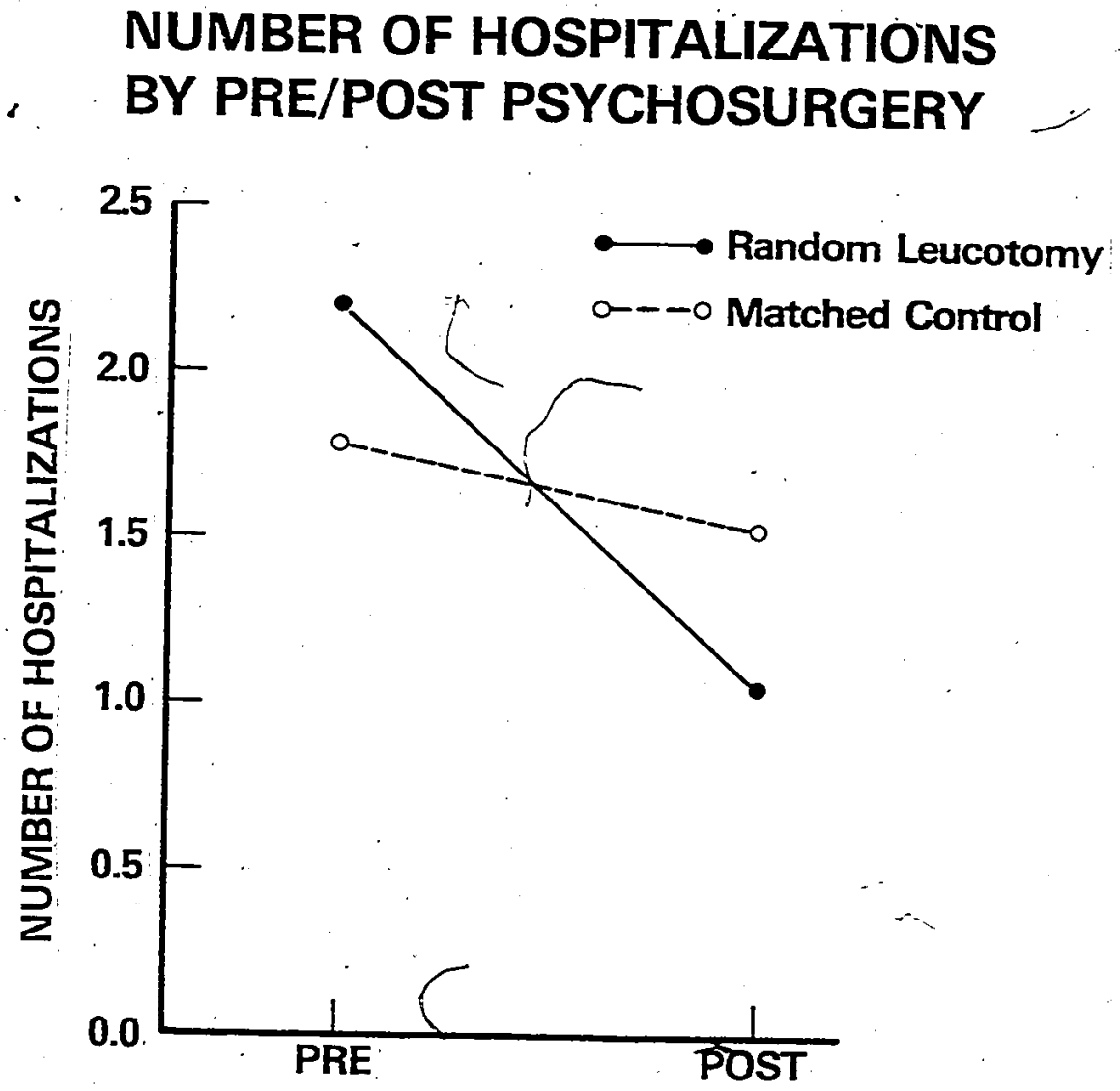


prepsychosurgery Leucotomy Scale ratings and the mean Leucotomy Scale ratings at 6 months, 1,2,3,4,5,6, and 7 years postoperatively. This graph indicates that the psychosurgery may have been group-wise effective in increasing the social adjustment of the leucotomized patients from requiring almost total nursing care to the point at which they could care for their basic needs and engage in at least minimal ward activities; that is, this supports the clinical impressions of the leucotomy personnel that the surgery was effective in reducing problems of ward management. The reduction of hospitalizations (see Figure 3) for the Random Leucotomy group vis-a-vis the Control group also confirms clinical impressions that the psychosurgery had a somewhat stabilizing effect.

Some indication of factors important for effective psychosurgery can be found in the successful-unsuccessful leucotomy comparisons. In addition to the obvious expected postoperative differences dictated by the selection procedure, the Successful group was strikingly differentiated from the Unsuccessful group on a number of good prognostic indicators. A greater proportion of the successful patients were married and at a higher economic level; also, the successful leucotomies as a group were first admitted to hospital later in life. These factors may be indicators of a better premorbid adjustment. Postoperative adjustment for the married patients may have been positively influenced by concerned family and concomitant support within the community. Another feature which distinguishes the successful from the unsuccessful leucotomies is the significantly shorter period of hospitalization prior to psychosurgery for the Successful group. Perhaps this shorter period in hospital prevented the so called institutionalization syndrome from occurring.

The final major feature which differentiates the successful and

Figure 3


NUMBER OF HOSPITALIZATIONS
BY PRE/POST PSYCHOSURGERY
NUMBER OF HOSPITALIZATIONS
2.5
2.0
1.5
1.0
0.5
0.0
PRE
POST
Random Leucotomy
Matched Control

and unsuccessful leucotomies is the greater incidence of affective disorders in the former group. Whether chemotherapy may provide the same function under today's conditions which ablation provided then is open to conjecture. Kalinowsky and Hippius (1969) find support in the literature and their clinical experience that psychosurgery is indicated presently in otherwise treatment-resistent "atypical" chronically depressed patients who do not respond to a regimen of antidepressants or ECT.

CHAPTER 5

SUMMARY AND CONCLUSIONS

In general, there were no systematic differences indicated in the leucotomy-random leucotomy, random leucotomy-control, and combined leucotomy-rejected-for-leucotomy group comparisons. Absolutely no support for a return to large scale psychosurgery of the 1950's can be gleaned from the results of the present study. However, the present day psychosurgery abolitionist's position, as espoused by Breggin (1972, 1973), cannot legitimately reap ammunition from these results either. "Those who expect to find evidence in this sample for systematic discrimination, psychiatric oppression, or other satanic intent will simply have to look elsewhere in the literature" (Adams, Note 1).

It is necessary to go beyond the rather equivocal results from the large group comparisons. Subgroup analyses, as in the successful leucotomy comparisons, begin to provide more heuristic data. While subgroup analyses have some clear potential to elucidate factors influencing successful response to psychosurgery, it is analyses at the level of the single case which have most to offer. Intraindividual analyses, as demonstrated in Reitan's (1966, 1974) approach to clinical neuropsychology may have considerable merit in the study of psychosurgical interventions. Individual differences before and after psychosurgery are likely obscured by group means, yet these differences probably contribute to the response to psychosurgery and likely constitute the significant psychological effects of psychosurgery. Carefully designed and evaluated intraindividual case studies against a backdrop of large sample results are necessary if rational decisions regarding the future of psychosurgery are to be made.

APPENDIX A

Leucotomy Scale

IN HOSPITAL		
	0 Points	Nursing problem No self care No work
	10 Points	No nursing problem No self care No work
	20 Points	No nursing problem Self care No work
	30 Points	No nursing problem Self care Working
OUT OF HOSPITAL		
	40 Points	Not working Requires supervision
	50 Points	Not working No supervision
	60 Points	Some work Requires supervision
70 - 80 - 90 - 100 Points (10 points each for)		Intellectually normal Emotionally normal Socially normal Working normally (as compared to prepsychotic state)

APPENDIX B

Results of Crosstabulation Analysis — (Combined) Leucotomy, Random Leucotomy, and Control Group Comparisons

Variable	Chi Square	Degrees of Freedom	Significance Level
Sex	1.59	2	0.4512
Marital status	13.49	16	0.6363
Race	11.61	12	0.4773
Place of birth	69.38	54	0.0776
Nationality	23.51	20	0.2645
Economic status	12.62	12	0.3973
Occupation	24.97	18	0.1256
Rural-urban environment	1.46	2	0.4813
Present status	12.70	12	0.3913
History of Epilepsy	9.50	8	0.3016
General diagnosis at first admission	9.68	10	0.4682
General diagnosis at psychosurgery	16.37	10	0.8960
Type of psychosurgery	3.39	5	0.6405
Death[a]	2.86	1	$p < 0.10$
Death[b]	0.79	1	$p > 0.20$

[a] Leucotomy by Random Leucotomy crosstabulation

[b] Random Leucotomy by Control crosstabulation

APPENDIX C

Results of Crosstabulation Analysis — Successful and Unsuccessful Leucotomy Group Comparisons

Variable	Chi Square	Degrees of Freedom	Significance Level
Sex	0.34	1	0.5607
Marital status	16.98	8	0.0303
Race	1.41	6	0.9650
Place of birth	26.12	24	0.3469
Nationality	14.24	8	0.0756
Economic status	13.09	5	0.0225
Occupation	10.30	9	0.3265
Rural-urban environment	0.24	1	0.6162
Present status	110.54	6	0.0
History of epilepsy	0.29	2	0.8634
General diagnosis at first admission	12.62	5	0.0272
General diagnosis at psychosurgery	16.52	5	0.0055
Type of psychosurgery	7.98	5	0.1571

APPENDIX D

Results of Crosstabulation Analysis — (Combined) Leucotomy and Rejected-for-Leucotomy Group Comparisons

Variable	Chi Square	Degrees of Freedom	Significance Level
Sex	1.64	1	0.2004
Marital status	12.64	8	0.1160
Race	0.26	6	0.9997
Place of birth	5.01	24	1.0000
Nationality	11.28	8	0.1861
Economic status	21.94	5	0.0005
Occupation	4.56	9	0.8708
Rural-urban environment	0.02	1	0.8687
Present status	2.07	6	0.9131
History of epilepsy	0.27	2	0.8747
General diagnosis at first admission	3.07	5	0.6889
General diagnosis at psychosurgery	8.75	5	0.1196
Death	0.08	1	$p > 0.20$

APPENDIX E

Results for Leucotomy-Random Leucotomy Comparisons (Ratio Variables)

Variable	Group	N	Mean	Standard Deviation	t-ratio	Degrees of Freedom	Two-tail Probability
Birthdate	1	273	1915.43	12.16	-1.54	370	0.124
	2	99	1917.68	13.39			
Date of first admission	1	277	1946.47	9.17	-1.96	375	0.050
	2	100	1948.53	8.42			
Age at first admission	1	273	31.17	10.41	0.33	370	0.744
	2	99	30.78	9.92			
Age at psychosurgery	1	272	41.46	11.45	1.32	369	0.186
	2	99	39.70	10.99			
Total history of psychiatric illness	1	277	20.63	11.58	1.44	375	0.151
	2	100	18.74	10.40			
Total period of psychiatric illness	1	277	15.42	11.00	1.85	375	0.064
	2	100	13.11	9.69			
Chronicity	1	276	10.39	8.47	1.78	211.89	0.076*
	2	100	8.86	6.96			
Length of hospitalizations prepsychosurgery	1	276	7.30	7.03	1.34	215.16	0.181*
	2	100	6.35	5.69			
Date of death	1	44	1966.06	6.11	-0.58	51	0.565
	2	9	1967.34	5.48			
Grade attained	1	267	8.41	2.87	-2.39	365	0.017
	2	100	9.21	2.85			

Incidence of familial psychopathology	1	277	0.61	0.89	0.26	375	0.793
	2	100	0.58	0.79			
ECT treatments prepsychosurgery	1	261	53.92	67.25	-0.85	128.48	0.398*
	2	92	62.63	90.14			
ECT treatments postpsychosurgery	1	277	5.31	23.98	0.09	217.43	0.932*
	2	100	5.11	19.18			
Insulin coma treatments prepsychosurgery	1	266	8.30	19.70	-0.32	358	0.749
	2	94	9.07	21.68			
Insulin coma treatments postpsychosurgery	1	275	0.00	0.00	0.00	373	1.000
	2	100	0.00	0.00			
Metrazol coma treatments prepsychosurgery	1	272	1.90	5.75	0.78	213.65	0.436*
	2	98	1.45	4.58			
Metrazol coma treatments postpsychosurgery	1	274	0.00	0.00	0.00	371	1.000
	2	99	0.00	0.00			
Admissions pre-psychosurgery	1	277	2.22	1.94	0.03	220.67	0.973*
	2	100	2.21	1.53			
Admissions post-psychosurgery	1	277	1.09	1.82	0.20	223.31	0.838*
	2	100	1.05	1.42			
Discharge time	1	266	5.87	5.26	2.38	359	0.020
	2	95	4.43	4.49			
First readmission time	1	129	8.44	5.05	0.82	177	0.413
	2	50	7.73	5.58			
Total period of readmissions	1	125	2.06	2.28	-0.55	60.08	0.583*
	2	48	2.38	3.85			

*Separate Variance Estimate

Note. Group 1 = Leucotomy Group
Group 2 = Random Leucotomy Group

APPENDIX F

Results for Random Leucotomy-Control Comparisons (Ratio Variables)

Variable	Group	N	Mean	Standard Deviation	t-ratio	Degrees of Freedom	Two-tail Probability
Birthdate	1	99	1917.68	13.39	-0.14	197	0.889
	2	100	1917.95	13.49			
Date of first admission	1	100	1948.53	8.42	-0.52	198	0.605
	2	100	1949.16	8.87			
Age at first admission	1	99	30.78	9.92	-0.29	197	0.772
	2	100	31.19	10.13			
Age at psychosurgery	1	99	39.70	10.99	0.20	197	0.843
	2	100	39.40	10.84			
Total history of psychiatric illness	1	100	18.74	10.40	0.47	198	0.642
	2	100	18.03	11.03			
Total period of psychiatric illness	1	100	13.11	9.69	0.45	198	0.653
	2	100	12.49	9.91			
Chronicity	1	100	8.66	6.96	0.63	198	0.528
	2	100	8.20	7.58			
Length of hospitalizations prepsychosurgery	1	100	6.35	5.69	0.26	198	0.793
	2	100	6.12	6.84			
Date of death	1	9	1967.34	5.48	0.63	21	0.537
	2	14	1965.56	5.75			
Grade attained	1	100	9.21	2.85	2.58	196	0.011
	2	98	8.16	2.86			

Incidence of familial psychopathology	1	100	0.58	0.79	-0.81	198	0.418
	2	100	0.68	0.94			
ECT treatments prepsychosurgery	1	92	62.63	40.14	3.83	112.39	0.0001*
	2	97	24.52	31.89			
ECT treatments postpsychosurgery	1	100	5.11	19.18	-1.88	187.66	0.061*
	2	98	9.73	15.16			
Insulin coma treatments prepsychosurgery	1	94	9.07	21.68	0.23	188	0.818
	2	96	8.32	23.19			
Insulin coma treatments postpsychosurgery	1	100	0.00	0.00	-2.06	195	0.041
	2	97	2.54	12.30			
Metrazol coma treatments prepsychosurgery	1	98	1.45	4.58	0.35	193	0.727
	2	97	1.23	4.27			
Metrazol coma treatments postpsychosurgery	1	99	0.00	0.00	0.00	194	1.000
	2	97	0.00	0.00			
Admissions pre-psychosurgery	1	100	2.21	1.53	2.23	172.51	0.027*
	2	99	1.80	1.02			
Admissions post-psychosurgery	1	100	1.05	1.41	-1.98	185.97	0.049*
	2	99	1.50	1.80			
Discharge time	1	266	5.87	5.26	2.38	359	0.018
	2	95	4.43	4.49			
First readmission time	1	50	7.73	5.58	1.35	108	0.180
	2	60	6.36	5.03			
Total period of readmissions	1	48	2.38	3.85	2.06	57.37	0.044*
	2	60	1.18	1.42			

*Separate Variance Estimate

Note. Group 1 = Random Leucotomy Group
Group 2 = Control Group

APPENDIX G

Results for Successful-Unsuccessful Leucotomy Comparisons (Ratio Variables)

Variable	Group	N	Mean	Standard Deviation	t-ratio	Degrees of Freedom	Two-tail Probability
Birthdate	1	71	1917.37	14.91	0.87	92.06	0.384*
	2	301	1915.71	11.88			
Date of first admission	1	71	1951.08	7.60	4.31	375	0.0001
	2	306	1946.08	9.06			
Age at first admission	1	71	33.69	11.43	2.41	370	0.017
	2	301	30.45	9.90			
Age at psychosurgery	1	71	40.96	12.00	-0.03	369	0.978
	2	300	41.00	11.20			
Total history of psychiatric illness	1	71	9.54	8.02	-11.60	131.89	0.0001*
	2	306	22.59	10.50			
Total period of psychiatric illness	1	71	5.09	5.11	-14.09	221.61	0.0001*
	2	306	17.06	10.40			
Chronicity	1	71	7.27	7.08	-3.17	374	0.002
	2	305	10.61	8.22			
Length of hospitalizations prepsychosurgery	1	71	3.22	3.30	-8.43	233.78	0.0001*
	2	305	7.94	6.98			
Date of death	1	0	0.00	0.00	-80.72	52	0.0001
	2	53	1966.28	5.98			
Grade attained	1	69	9.04	2.76	1.33	365	0.183
	2	298	8.53	2.91			

Incidence of familial psychopathology	1	71	0.70	0.85	1.13	375	0.257
	2	306	0.58	0.87			
ECT treatments prepsychosurgery	1	65	36.95	24.78	-4.18	322.73	0.0001*
	2	288	66.53	80.32			
ECT treatments postpsychosurgery	1	71	0.17	1.12	-4.35	310.15	0.0001*
	2	306	6.44	25.14			
Insulin coma treatments prepsychosurgery	1	64	7.61	20.90	-0.39	358	0.698
	2	296	8.70	20.09			
Insulin coma treatments postpsychosurgery	1	71	0.00	0.00	0.00	373	1.000
	2	304	0.00	0.00			
Metrazol coma treatments prepsychosurgery	1	70	0.77	2.72	-2.64	237.64	0.009*
	2	300	2.02	1.85			
Metrazol coma treatments postpsychosurgery	1	70	0.00	0.00	0.00	371	1.000
	2	303	0.00	0.00			
Admissions pre-psychosurgery	1	71	2.27	1.82	0.27	375	0.789
	2	306	2.20	1.85			
Admissions post-psychosurgery	1	71	0.00	0.00	-12.19	325.54	0.0001*
	2	306	1.32	1.82			
Discharge time	1	71	1.84	2.67	-10.37	213.37	0.0001*
	2	290	6.39	5.16			
First readmission time	1	0	0.00	0.00	-21.21	178	0.0001
	2	179	8.25	5.20			
Total period of readmissions	1	0	0.00	0.00	-10.10	172	0.0001
	2	173	2.15	2.80			

*Separate Variance Estimate

Note. Group 1 = Successful Leucotomy Group
Group 2 = Unsuccessful Leucotomy Group

APPENDIX H

Results for (Combined) Leucotomy and Rejected-for-Leucotomy Comparisons (Ratio Variables)

Variable	Group	N	Mean	Standard Deviation	t-ratio	Degrees of Freedom	Two-tail Probability
Birthdate	1	372	1916.02	11.93	0.88	15.62	0.392*
	2	16	1912.19	17.25			
Date of first admission	1	377	1947.02	9.01	0.22	391	0.826
	2	16	1946.51	8.93			
Age at first admission	1	225	37.69	11.11	-2.39	230	0.018
	2	7	47.98	15.09			
Age at psychosurgery	1	371	41.00	11.35	0.38	381	0.705
	2	12	39.73	11.88			
Total history of psychiatric illness	1	377	20.13	11.29	0.48	391	0.634
	2	16	18.75	13.22			
Total period of psychiatric illness	1	377	14.81	10.70	0.51	391	0.612
	2	16	13.42	10.20			
Chronicity	1	376	9.98	8.11	1.22	386	0.222
	2	12	7.10	5.22			
Length of hospitalications prepsychosurgery	1	376	7.05	6.71	0.78	386	0.435
	2	12	5.52	4.29			
Date of death	1	53	1966.28	5.98	0.69	54	0.491
	2	3	1963.77	8.59			
Grade attained	1	367	8.63	2.88	0.12	380	0.902
	2	15	8.53	2.95			

Incidence of familial psychpathology	1	377	0.60	0.86	-1.80	391	0.072
	2	16	1.00	1.03			
ECT treatments prepsychosurgery	1	311	63.78	75.56	0.24	322	0.810
	2	13	58.61	80.06			
ECT treatments postpsychosurgery	1	76	26.09	45.28	2.38	77.93	0.020*
	2	4	13.50	1.91			
Insulin coma treatments prepsychosurgery	1	58	52.76	13.99	-0.56	60.	0.575
	2	4	56.75	4.72			
Insulin coma treatments postpsychosurgery	1	0	0.00	0.00	0.00	0	0.500
	2	0	0.00	0.00			
Metrazol coma treatments prepsychosurgery	1	44	14.96	7.33	-0.96	44	0.343
	2	2	20.00	0.00			
Metrazol coma treatments postpsychosurgery	1	0	0.00	0.00	0.00	0	0.500
	2	0	0.00	0.00			
Admissions pre-psychosurgery	1	377	2.21	1.84	-0.34	391	0.740
	2	16	2.38	2.03			
Admissions post-psychosurgery	1	377	1.08	1.72	1.04	391	0.300
	2	16	0.63	1.31			

*Separate Variance Estimate

Note. Group 1 = (Combined) Leucotomy Group
Group 2 = Rejected-for-Leucotomy Group

REFERENCE NOTE

1. Adams, K. M. Status of psychosurgery patients in the hospital and community. Paper presented at the meeting of the American Psychological Association, San Francisco, August, 1977.

Bibliography

Andy, O. J. Neurosurgical treatment of abnormal behaviour. American Journal of Medical Sciences, 1966, 252, 232-238.

Annas, G. J., & Glantz, L. H. Psychosurgery: The law's response. In S. Fried (Ed.), Psychosurgery: A multi-disciplinary symposium. Lexington, Massachusetts: D. C. Heath and Company, 1974.

Balasubramaniam, V., Kanaka, T. S., & Ramamurthi, B. Surgical treatment of hyperkinetic and behaviour disorders. International Surgery, 1970, 54, 18-23.

Ballantine, H. T., Cassidy, W. L., Brodeur, J., & Giriunas, I. Frontal cingulotomy for mood disturbance. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Ballantine, H. T., Cassidy, W. L., Flanagan, N. B., & Marino, R. Stereotaxic anterior cingulotomy for neuropsychiatric illness and intractable pain. Journal of Neurosurgery, 1967, 26, 488-495.

Baker, E. F. W., Young, M. P., Gauld, D. M., & Fleming, J. F. R. A new look at bimedial prefrontal leukotomy. The Canadian Medical Association Journal, 1970, 102, 37-41.

Bernstein, I. C., Callahan, W. A., & Jaranson, J. M. Lobotomy in private practice. Archives of General Psychiatry, 1975, 32, 1041-1047.

Bingley, T., Leksell, L., Meyerson, B. A., & Rylander, G. Stereotactic anterior capsulotomy in anxiety and obsessive-compulsive states. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Boyd, B. A., Weber, W. E., & McKenzie, K. G. Leucotomy-Its therapeutic value on the disturbed wards of a mental hospital. Canadian Psychiatric Association Journal, 1958, 3, 170-179.

Breggin, P. R. The return of lobotomy and psychosurgery. Congressional Record, 118(26), Feb. 24, 1972.

Breggin, P. R. The second wave. Mental Hygiene, 1973, 57, 11-13.

Bridges, P. K., & Goktepe, E. O. A review of patients with obsessional symptoms treated by psychosurgery. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Brouger, B., & Olesen, K. Psychosurgery in sixty-three cases of open cingulectomy and fourteen cases of bifrontal prehypothalamic cryolesion. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Burckhardt, G. Ueber rindenexcisionen, als bertrag zur operativen therapie der psychosen. Allg. Z. Psychiatry, 1891, 47, 463-548.

Choppy, M., Zimbacca, N., & LeBeau, J. Psychological changes after selective frontal surgery (especially cingulotomy) and after stereotactic surgery of the basal ganglia. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Chorover, S. L. Psychosurgery: A neuropsychological perspective. In S. Fried (Ed)., Psychosurgery: a multi-disciplinary symposium. Lexington, Massachusetts: D. C. Heath and Company, 1974.

Corsellis, J. A. N., & Jack, A. B. Neuropathological observations on yttrium implants and on undercutting in the orbito-frontal areas of the brain. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Dax, E. C., Reitman, F., & Radley-Smith, J. Investigation into clinical problems and prefrontal leucotomy. 1st International Conference on Psychosurgery. Lisbon: Livraria Luso-Espanhola, 1949.

Dynes, J. B. Lobotomy - twenty years later. Virginia Medical Monthly, 1968, 95, 306.

Egan, G. Results of isolation of the orbital lobes in leucotomy. Journal of Mental Science, 1949, 95, 115.

Fairman, D. Evolution of psychosurgery technic. In M. Greenblatt, R. Arnot, & H. C. Solomon (Eds.), Studies in lobotomy. New York: Grune and Stratton, Inc., 1950.

Falconer, M. A., & Schurr, R. P. Surgical treatment of mental illness. In G. W. T. H. Fleming, A. Walk, J. London, & A. Churchill (Eds.), Recent Progress in Psychiatry, 1959.

Fleming, J. F. R., & Baker, E. F. W. Bimedial prefrontal leukotomy. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Foltz, E. Pain release by frontal cingulotomy. Journal of Neurosurgery, 1962, 19, 89.

Freeman, W. J. Transorbital leucotomy: The deep frontal cut. Proceedings of the Royal Society of Medicine, 1949, 42, Supp. 8-12.

Freeman, W. Psychosurgery: A quarter of a century later. In Proceedings, Third World Congress of Psychiatry (Vol. 1). Toronto: University of Toronto Press, 1961.

Freeman, W. J. Frontal lobotomy in early schizophrenia: long follow-up in 415 cases. British Journal of Psychiatry, 1971, 119, 621-624.

Freeman, W., & Watts, J. W. Psychosurgery (1st ed.). Springfield, Illinois: Charles C. Thomas, 1942.

Fried, S. Psychosurgery: a multidisciplinary symposium. Lexington, Massachusetts: D. C. Heath and Company, 1974.

Fulton, J. F. Frontal lobotomy and affective behaviour. New York: W. W. Norton & Company, 1951.

Fulton, J. F., & Jacobsen, C. F. The functions of the frontal lobes, a comparative study in monkeys, chimpanzees and man. Advances in Modern Biology (Moscow), 1935, 4, 113-123.

Gaches, J., LeBeau, J., & Choppy, M. Psychosurgery in severe obsessive syndromes. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Grantham, E. G. Prefrontal lobotomy for relief of pain, with a report of a new operative technique. Journal of Neurosurgery, 1951, 8, 405.

Greenblatt, M., Arnot, A., & Solomon, H. C. Studies in lobotomy. New York: Grune & Stratton, 1950.

Greenblatt, M., & Solomon, H. C. Frontal lobes and schizophrenia. New York: Springer, 1953.

Hamlin, R. M. Intellectual function 14 years after frontal lobe surgery. Cortex 6, 1970, 3, 311-318.

Hassler, R., & Dieckmann, G. Relief of obsessive-compulsive disorders, phobias, and tics by stereotactic coagulation of the central intralaminar and medialthalamic nuclei. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Hetherington, R. F., Haden, P., & Craig, W. J. Neurosurgery in affective disorder: criteria for selection of patients. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Hirose, S. Psychosurgery 1947-60: Evaluation of 450 patients treated by prefrontal lobotomy and a new method of orbito-ventromedial undercutting. In Proceedings, Third World Congress of Psychiatry (Vol. 1). Toronto: University of Toronto Press, 1961.

Hirose, S. Orbito-ventromedial undercutting 1957-63. Follow-up of 77 cases. American Journal of Psychiatry, 1965, 121, 1194.

Hirose, S. The case selection of mental disorder for orbitoventromedial undercutting. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Hitchcock, E. R., Ashcroft, G. W., Cairns, V. M., & Murray, L. G. Observations on the development of an assessment scheme for amygdalotomy. In L. V. Laitinen, & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Hitchcock, E., Laitinen, L., & Vaernet, K. Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Holden, M. J., Peterson, D. B., Hofstatter, L., & Olson, G. Applications of the inferomedial lobotomy operation in psychiatric illness. In E. Hitchock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Hunter-Brown, B. Further experience with multiple limbic targets for schizophrenia and aggression. In L. V. Laitinen, & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Kalinowsky, L. B. Attempt at localization of psychological manifestations observed in various psychosurgial procedures. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Kalinowsky, L. B., & Hippius, H. Pharmacological, convulsive and other somatic treatments in psychiatry. New York: Grune and Stratton, 1969.

Kelly, D., Richardson, A., & Mitchell-Heggs, N. Technique and assessment of limbic leucotomy. In L. V. Laitinen, & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Kennedy, E. M. Forward. In S. Fried (Ed.), Psychosurgery: a multidisciplinary symposium. Lexington, Massachusetts: D. C. Heath and Company, 1974.

Kim, Y. K., & Umbach, W. Combined stereotactic lesions for treatment of behaviour disorders and severe pain. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Knight, G. C. 330 cases of restricted orbital undercutting. Proceedings of the Royal Society of Medicine, 1960, 53, 728.

Knight, G. C. The orbital cortex as an objective in the surgical treatment of mental illness. The results of 450 cases of open operation and the development of the stereotactic approach. British Journal of Surgery, 1964, 51, 114.

Knight, G. C. Bi-frontal stereotactic tractotomy: An atraumatic operation of value in the treatment of intractable psychoneurosis. British Journal of Psychiatry, 1969, 115, 257-266.

Knight, G. C. Neurosurgical aspects of psychosurgery. Proceedings of the Royal Society of Medicine, 1972, 65, 1099-1204.

Knight, G. Additional stereotactic lesions in the cingulum following failed tractotomy in the subcaudate region. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Knight, G. C., & Fredgold, R. F. Orbital leucotomy. A review of 52 cases. Lancet, 1955, i, 981.

Kolb, L. C. Clinical evaluation of prefrontal lobotomy. Journal of the American Medical Association, 1953, 152, 1085.

Kulberg, G. Experiences with small stereotaxic lesions in the frontal lobes. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Laitinen, L. V. Stereotactic lesions in the knee of the corpus callosum in the treatment of emotional disorders. Lancet, 1972, i, 472.

Laitinen, L. V., & Livingston, K. E. Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Laitinen, L. V., & Vilki, J. Stereotaxic ventral anterior cingulotomy in some psychological disorders. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

LeBeau, J. Anterior cingulotomy in man. Journal of Neurosurgery, 1954, II, 268.

Lewin, W. Selective leucotomy: a review. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Lindstrom, P. A. Prefrontal sonic treatment - sixteen years' experience. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Livingston, K. E. Angulate cortex isolation for the treatment of psychoses and psychoneuroses. Association for Research into Nervous and Mental Disease, 1953, 31, 374-378.

Lopez-Ibor, J. J., & Burzaco, J. Stereotaxic anterior limb capsulotomy in selected psychiatric patients. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Lyerly, J. G. Transection of the deep association fibres of the prefrontal lobes in certain mental disorders. Southern Surgeon, 1939, 8, 426-434.

Mark, V. H., & Ervin, F. R. Violence and the brain. New York: Harper and Row, 1970.

Marks, I. M., Birley, J. L. T., & Gelder, M. G. Modified leucotomy in severe agoraphobia: a controlled serial inquiry. British Journal of Psychiatry, 1966, 112, 757-769.

McKenzie, K. G., & Kaczanowski, G. Prefrontal leukotomy: a five-year controlled study. The Canadian Medical Association Journal, 1964, 91, 1193-1196.

Medina, R. F., Pearson, J. S., & Buckstein, R. F. The long-term evaluation of prefrontal lobotomy in chronic psychotics. Journal of Nervous and Mental Disease, 1954, 119, 23.

Mettler, F. A. (Ed.). Selective partial ablation of the frontal cortex: a correlative study of its effects on human psychotic subjects, the Columbia-Greystone Associates. New York: Hoeber, 1949.

Mettler, F. A., & Rowland, L. P. Relation of the trephine opening (Freeman-Watts lobotomy point) to the underlying cerebrum. Presented before annual meetings of American Neurological Association, 1948.

Meyer, G., McElhaney, M., Martin, W., & McGraw, C. P. Stereotactic cingulotomy with results of acute stimulation and serial psychological testing. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Miller, A. Lobotomy, a clinical study (Monograph No. 1), Ontario Department of Health. Toronto: Queen's Printer, 1954.

Mingrino, S., & Schergna, E. Stereotaxic anterior cingulotomy in the treatment of severe behaviour disorders. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois, Charles C. Thomas, 1972.

Moniz, E. Prefrontal leucotomy in the treatment of mental disorder. American Journal of Psychiatry, 1936, 93, 1379-1385.

Moniz, E. Tentatives operatories dans le traitement de certaines psychoses. Paris: Nasson, 1936.

Nadvornik, P., Pogady, J., & Sramka, M. The results of stereotactic treatment of the aggressive syndrome. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Narabayashi, H., & Shima, F. Which is the better amygdala target, the medial or lateral nuclei? In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Orthner, H., Muller, D., & Roeder, F. Stereotaxic psychosurgery techniques and results since 1955. In E. Hitchcock, L. Laitinen, & K. Waernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Penfield, W. Symposium on gyrectomy. In J. K. Fulton (Ed.), Frontal lobes. Baltimore: Williams & Wilkins, 1948.

Peterson, M. C., Dodge, H. W., Sem-Jacobsen, C. W., Lazarte, J. A., & Holman, C. B. Clinical results of selective leukotomy based on intracerebral electrography. Journal of the American Medical Association, 1955, 774-775.

Pool, J. L. Topectomy. Proceedings of the Royal Society of Medicine, 1949, 1-3.

Poppen, J. L. Technic of prefrontal lobotomy. Journal of Neurosurgery, 1948, 5, 514-520.

Post, F., Rees, W. L., & Schurr, P. H. An evaluation of bimedial leucotomy. British Journal of Psychiatry, 1968, 114, 1223-1246.

Reitan, R. M. A research programme on the psychological effects of brain lesions in human beings. In N. R. Ellis (Ed.), International review of research in mental retardation (Vol. 1). New York: Academic Press, 1966.

Reitan, R. M. Methodological problems in clinical neuropsychology. In R. M. Reitan & L. A. Davison (Eds.), Clinical Neuropsychology: Current status and applications. Washington, D. C.: Winston, 1974.

Robin, A. A. A controlled study of the effects of leucotomy. Journal of Neurology, Neurosurgery, and Psychiatry, 1958, 21, 262-269.

Rylander, G. Personality analysis before and after frontal lobotomy. Research Publication: Association for Research into Nervous and Mental Diseases, 1948, 27, 691.

Rylander, G. The renaissance of psychosurgery. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Sana, K. Sedative neurosurgery. Neurologia medico-chirurgica, 1962, 4, 112-142.

Sargant, W. The present indications for leucotomy. Lancet, 1962, 1, 1197-1200.

Scoville, W. B. Selective cortical undercutting as a means of modifying and studying frontal lobe function in man. Journal of Neurosurgery, 1949, 6, 65-73.

Scoville, W. B., Wilk, E. K., & Pepe, A. J. Selective cortical undercutting: results in new method of fractional lobotomy. American Journal of Psychiatry, 1951, 107, 730.

Scoville, W. B. Psychosurgery and other lesions of the brain affecting human behaviour. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Scoville, W. B. Surgical locations for psychiatric surgery with special reference to orbital and cingulate operations. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Siegfried, J., & Ben-Shmuel, A. Long-term assessment of stereotactic amygdalotomy for aggressive behaviour. In L. V. Laitinen & K. E. Livingston (Eds.), Surgical approaches in psychiatry. Baltimore: University Park Press, 1973.

Smith, A., & Kinder, E. F. Changes in psychological test performances of brain-operated schizophrenics after eight years. Science, 1959, 129, 149.

Strom-Olsen, R., & Carlisle, S. Bifrontal stereotaxic tractotomy. A follow-up study. In E. Hitchcock, L. Laitinen, & K. Vaernet (Eds.), Psychosurgery. Springfield, Illinois: Charles C. Thomas, 1972.

Sweet, W. H. Treatment of medically intractable mental disease by limited frontal leucotomy - justifiable? New England Journal of Medicine, 1973, 289(21), 1117-1125.

Sykes, M. K., & Tredgold, R. F. Restricted orbital undercutting: a study of its effects on 350 patients over the ten years 1951-1960. British Journal of Psychiatry, 1964, 110, 609-640.

Tan, E., Marks, I. M., & Marset, P. Bimedial leucotomy in obsessive-compulsive neurosis: a controlled serial enquiry. British Journal of Psychiatry, 1971, 118, 115-164.

Tow, P. M. Personality changes following frontal leucotomy, a forty-year experience. New York: Oxford University Press, 1955.

Tow, P. M., & Lewin, W. Orbital leucotomy. Lancet, 1953, 2, 644.

Turnbull, F. Neurosurgery in the control of unmanageable affective reactions: a critical review. Clinical Neurosurgery, 1968, 16, 218–233.

Vaernet, K., & Madsen, A. Stereotaxic amygdalotomy and basofrontal tractotomy in psychotics with aggressive behaviour. Journal of Neurology, Neurosurgery, and Psychiatry, 1970, 33, 858–863.

Valenstein, E. S. Brain control. New York: John Wiley & Sons, 1973.

Webb, E., Campbell, D. T., Schwartz, R. D., & Sechrest, L. Unobstrusive measures: non-reactive research in the social sciences. Chicago: Rand McNally, 1970.

Whitty, C. W. M., Duffield, J. E., Tow, P. M., & Cairns, H. Anterior cingulectomy in the treatment of mental disease. Lancet, 1952, 262, 475–481.

Williams, J. M., & Freeman, W. Evaluation of lobotomy with special reference to children. Research Publications: Association for Research into Nervous and Mental Disease, 1953, 31, 299–307.

Winter, A. (Ed.). The surgical control of behaviour. Springfield, Illinois: Charles C. Thomas, 1971.

VITA AUCTORIS

Michael Joschko was born on April 6, 1952 in Hohenkirchen, West Germany. He graduated from Niagara Falls Collegiate Vocational School, Niagara Falls, Ontario in June, 1971. In June, 1975 he graduated, with a Bachelor of Science Degree, summa cum laude, from McMaster University, Hamilton, Ontario. Since September 1976 he had been enrolled in the Doctoral programme in clinical psychology at the University of Windsor.