The origins and persistence of psychosurgery in the state of Iowa

Francis J. Jareczek, BS, BA,¹ Marshall T. Holland, MD,² Matthew A. Howard III, MD,² Timothy Walch, PhD,² and Taylor J. Abel, MD²

²Department of Neurosurgery, ¹University of Iowa Carver College of Medicine, Iowa City, Iowa

Neurosurgery for the treatment of psychological disorders has a checkered history in the United States. Prior to the advent of antipsychotic medications, individuals with severe mental illness were institutionalized and subjected to extreme therapies in an attempt to palliate their symptoms. Psychiatrist Walter Freeman first introduced psychosurgery, in the form of frontal lobotomy, as an intervention that could offer some hope to those patients in whom all other treatments had failed. Since that time, however, the use of psychosurgery in the United States has waxed and waned significantly, though literature describing its use is relatively sparse. In an effort to contribute to a better understanding of the evolution of psychosurgery, the authors describe the history of psychosurgery in the state of Iowa and particularly at the University of Iowa Department of Neurosurgery. An interesting aspect of psychosurgery at the University of Iowa is that these procedures have been nearly continuously active since Freeman introduced the lobotomy in the 1930s. Frontal lobotomies and transorbital leukotomies were performed by physicians in the state mental health institutions as well as by neurosurgeons at the University of Iowa Hospitals and Clinics (formerly known as the State University of Iowa Hospital). Though the early technique of frontal lobotomy quickly fell out of favor, the use of neurosurgery to treat select cases of intractable mental illness persisted as a collaborative treatment effort between psychiatrists and neurosurgeons at Iowa. Frontal lobotomies gave way to more targeted lesions such as anterior cingulotomies and to neuromodulation through deep brain stimulation. As knowledge of brain circuits and the pathophysiology underlying mental illness continues to grow, surgical intervention for psychiatric pathologies is likely to persist as a viable treatment option for select patients at the University of Iowa and in the larger medical community.

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NEUROSURGERY for the treatment of psychological disorders has a checkered history in the United States. Prior to the era of antipsychotic medications, individuals with severe mental illness were often institutionalized and subjected to extreme therapies with little evidence of efficacy in a last-ditch attempt to palliate their symptoms. For example, treatments included hydrotherapy¹⁰ and insulin shock therapy.²⁰

When psychosurgery in the form of frontal lobotomy was first introduced, the underlying premise of its disruption of pathological connections in the brain led to its rapid dissemination and uptake across the US. This initial progress was due in large part to the efforts of its major proponent, psychiatrist Walter Freeman. Since that time, however, interest in (and the infamy of) psychosurgery in the US has waxed and waned significantly. At some hospitals, psychosurgery has disappeared completely, and at

other hospitals, it has continued to progress and at times prosper. Unfortunately, any assessment of the state of psychosurgery is biased because, in large part, literature describing the historical span of psychosurgery at individual institutions and neurosurgical divisions is lacking. Additional research and publication would provide an important index for the history of psychosurgery in the US. In an effort to contribute to a better understanding of the evolution of psychosurgery in the US, we describe the history of psychosurgery in the state of Iowa and particularly at the University of Iowa Department of Neurosurgery.

An interesting aspect of psychosurgery at the University of Iowa is that psychosurgical procedures have been almost continuously active since the introduction of the lobotomy by Freeman in the 1930s. Mental health providers and neurosurgeons in the state of Iowa were immediately enthusiastic about the lobotomy introduced by Freeman

ABBREVIATIONS DBS = deep brain stimulation; FDA = Food and Drug Administration; MHI = mental health institution; OCD = obsessive-compulsive disorder; SUI = State University of Iowa; VA = Veterans Administration.

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and the potential benefit it could bring to patients suffering from intractable mental illness, and it was performed to varying extents by physicians in the state mental health institutions as well as by neurosurgeons at the University of Iowa Hospitals and Clinics (formerly known as the State University of Iowa [SUI] Hospital).

Although the early technique of frontal lobotomy quickly fell out of favor, the use of neurosurgical techniques to treat selected cases of intractable mental illness persisted through the years as a collaborative treatment effort between the psychiatrists and neurosurgeons at Iowa. Frontal lobotomies gave way to more targeted lesions such as anterior cingulotomies and further refinement by similarly targeted yet less destructive neuromodulation through deep brain stimulation. As knowledge of brain circuits and the pathophysiology underlying mental illness continues to grow, surgical intervention for psychiatric pathologies is likely to persist as a viable treatment option for selected patients at the University of Iowa and in the larger medical community.

The Early Years of Psychosurgery in Iowa: Practices at the State Mental Institutions and the Work of Dr. Russell Meyers at the State University of Iowa

Manipulation of the frontal lobe to treat mental illness was first performed by Portuguese neurologist Antonio Egas Moniz and neurosurgeon Pedro Almeida Lima in 1935 when they injected alcohol to produce a lesion. Subsequent refinement of the technique led to the design of a “leucotome” (Fig. 1), a metal instrument designed to physically remove a small volume of brain tissue consistently—or at least as compared with the alcohol injection.⁶ The leucotome, or leukotome, as it has more recently been spelled, was a straight metal instrument with a retractable wire loop that projected laterally from the tip of the device. After an opening was made in the patient’s skull above the frontal lobe, the instrument was inserted—without direct visualization—into the subcortical white matter. The wire loop was then extended and the instrument rotated to create “precise” spherical “cores” of 1-cm diameter. Moniz and Lima’s first group of patients received 6 lesions on each side. The procedure could be repeated if the physicians decided an adequate response was not observed after the initial surgery.⁶

In 1936, after attending a presentation by Moniz at a conference in London, psychiatrist Walter Freeman and neurosurgeon James Watts from Georgetown University brought the technique of frontal lobotomy to the US. While they initially used the technique described by Moniz, Freeman and Watts soon modified it to more completely disrupt connections between the frontal lobes and the rest of the brain.²⁴ These physicians further refined this technique by developing a “precision leukotome.” Per their report, these modifications led to improved outcomes, and they published a manuscript describing their first 200 cases in 1942.⁸

Given some of the complications of their original surgical technique—hemorrhage and epilepsy, in particular—Freeman developed a less invasive approach in the trans-

FIG. 1. Leucotome advertisement from 1950. Reproduced from *Brain* 73(3):v, 1950 (<https://academic.oup.com/brain/issue/73/3>).

orbital technique, which was thought to reduce the incidence of these complications while maintaining therapeutic efficacy.²⁴ Watts, the more conservative of the two, was opposed to neurosurgical interventions being performed by individuals without any formal surgical training and left the partnership in the mid-1950s. Having established a methodology that was rapid, minimally invasive, and with few apparent complications, Freeman turned his attention to disseminating his technique nationally.

During his travels through Iowa, Freeman trained psychiatrists at the state mental health institutions (MHIs) at Cherokee, Clarinda, Independence, and Mount Pleasant (Fig. 2). The procedure was initially accepted with skepticism and reserved for “deteriorated” patients who had “a great deal of emotional tension” and for whom other conventional treatments of the era had failed. These ineffective procedures could include psychotherapy, hydrotherapy, insulin shock therapy, narcosurgery, malaria therapy, electroconvulsive therapy, or a combination.^{11,21} In response, the head of the University of Iowa Psychopathic Hospital cautiously described psychosurgery as having “a useful application in hopeless cases.”¹⁶

As reports of positive outcomes began to emerge from the Iowa MHIs^{5,21} and other institutions across the country, the procedure became more widely accepted. Interestingly, an early publication based on questionnaires suggests that very few lobotomies—a reported total of 16—were performed in Iowa prior to mid-1949.¹⁴ Other reports published by individuals performing these interventions indicate that the actual number of procedures was significantly larger—more likely totaling in the hundreds. At the Mount Pleasant MHI, for example, some providers presented surgery “as a necessity and often times the only means for improvement,” such that “lobotomy [became] ... ‘the operation of choice’ for the chronically disturbed.”¹⁹ Local newspapers such as *The Des Moines Register* likely contributed to the popularization of the procedure, claiming that “modern psychosurgery is almost as safe as an appendix operation.”¹⁸

Transorbital lobotomies were offered at various hospitals across Iowa. The Knoxville Veterans Administration

FIG. 2. Map demonstrating the location of mental health facilities available in Iowa in 1952. Arrows denote the state MHIs at Cherokee, Clarinda, Independence, and Mount Pleasant. Reproduced from Johnson DB: *Mental Health Facilities in Iowa: A Descriptive Handbook*. Iowa City: Institute of Public Affairs, 1952.

(VA) hospital initially paid Harold Buchstein, a neurosurgeon from Minnesota, to travel to Knoxville to perform the procedures as prescribed. In fact, government administrators discussed having the Iowa City VA hospital approved as a “lobotomy center” in an effort to reduce costs.¹³ *Mental Health Facilities in Iowa: A Descriptive Handbook*, published by the Institute of Public Affairs at the State University of Iowa, indicates that psychosurgery was also offered by the psychiatry units at Allen Memorial Hospital in Waterloo, Iowa Methodist in Des Moines, and St. Joseph Mercy and St. Vincent’s Hospital in Sioux City.¹¹ Procedures were performed on site at all 4 of the state MHIs. Interestingly, the State Psychopathic Hospital affiliated with SUI in Iowa City is not listed as offering psychosurgery as a treatment option. It should be noted, however, that all of the state MHIs report sending patients to SUI Hospital for the procedures.¹¹

At Cherokee (Fig. 3), the MHI farthest from Iowa City, it appears that the majority of the procedures were performed by the medical staff of the institution, with half or more performed by the superintendent, psychiatrist W.C. Brinegar.⁵ Brinegar reported improvements in both temperament and function for a sizable fraction of patients undergoing the procedures. He noted that intraoperative complications were rare (less than 1%) and easily ad-

dresssed: “It is possible to break the Freeman transorbital leukotome ... if too much force is used. This happened to the author just once and he was able to remove the broken instrument immediately by the use of a pair of ordinary pliers, which he obtained from the glove compartment of his automobile.”⁵ Postoperative complications were very infrequent and included hemorrhage as well as seizures. On occasion, Cherokee patients would be referred to the University Hospital in Iowa City to have the procedure performed by a neurosurgeon. This was common for cases in which the transorbital approach was deemed inappropriate and would instead require an open procedure.²²

Operations at the other state institutions were performed by a “consulting neurosurgeon.” While a neurosurgeon from Omaha assisted with some of the procedures at the nearby Clarinda MHI,²¹ this “consultant” was typically a resident from the University Hospital under the supervision of Dr. Russell Meyers, head of the Division of Neurosurgery at SUI (Fig. 4).^{11,23} Even though Meyers is perhaps best known for his pioneering work in treating movement disorders with stereotactic neurosurgery, he was also the primary neurosurgeon performing many of the psychosurgeries—both open frontal lobotomies and transorbital leukotomies—at the state MHIs and at the University Hospital in the 1940s and 1950s.¹

FIG. 3. Postcard depicting the state MHI at Cherokee. Reproduced from <http://www.kirkbridebuildings.com/buildings/cherokee/>.

Correspondence between Meyers and former resident Donald Sweeney (University of Iowa Department of Neurosurgery Archives) suggests that Meyers favored the transorbital approach and was a strong proponent of psychosurgery in general: “As far as I can see, mortality, morbidity, and accessibility to the large number of patients that may profit from lobotomy is made possible by a transorbital approach.” He and neurosurgery resident Jess Schwidde would travel to the Independence MHI (Fig. 5) to “do approximately a dozen [leukotomies] each Thursday,” and they were “rather well pleased at the results.” Some patients from the Independence MHI were brought in to the University Hospital for surgery; however, this number was relatively small. In a *Daily Iowan* article reporting the successes of the procedure, Schwidde comments that the operation is “not as serious or involved as the layman probably thinks. The whole procedure can be done in about 10 minutes.”³ As the number of procedures grew, Meyers and his trainees became quite proficient, performing as many as 13 leukotomies in 55 minutes (correspondence between R. Meyers and D. Sweeney, University of Iowa Department of Neurosurgery Archives).

In his communications with Sweeney, Meyers provided an interesting word of caution, stating that “one objection ... that may reasonably be raised against the transorbital approach ... is that it is so simple that it may be carried out by inexpert individuals without the exercise of much discrimination.” He then continues:

On the other hand, if we were to condemn all useful procedures in medicine on the ground that the procedure is simple enough to make it usable, by inexpert individuals who employ the procedure both indiscriminately and unscrupulously, we would by that virtue withdraw from ourselves a great many valuable measures. We must remember that such an objection is not to the procedure but to the individuals who employ it.

Meyers closed this topic of conversation with Sweeney by noting that, in the hands of a skilled and discriminating neurosurgeon, this procedure had the potential to facilitate

the “relief of human suffering” and should be made available to “the hundreds of patients languishing in our state institutions and suffering from mental derangements.”

Although little definitive evidence exists documenting the number of psychosurgical procedures performed in this era, a review of various case series, newspaper articles, and personal and professional communications suggests that several hundred open and transorbital lobotomies were performed in the state of Iowa during Meyers’s tenure. While Meyers himself performed many of these operations, the rest were performed at the state MHIs and community hospitals by other medical professionals, including psychiatrists, neurologists, and, less commonly, neurosurgeons from neighboring states.

As the number of procedures performed throughout the US continued to grow, members of the medical community began to more openly express concern about indiscriminate use of the operation as well as the potential for adverse outcomes when these surgeries were performed by individuals with no surgical training.⁶ Concurrently, pharmacological treatments for mental illness were being discovered and developed. The first antipsychotic drug, chlorpromazine, was found to be effective in reducing psychotic agitation “without changing mental content significantly”³ and was approved by the Food and Drug Administration (FDA) in 1954. Other antipsychotic and antidepressant medications would soon follow, and they quickly became recognized as safer, and potentially more effective, alternatives to surgery. It is thought that the rise of this new treatment modality, rather than concerns for efficacy and long-term side effects, may actually be the primary underpinning for the decline in psychosurgery over the subsequent decades.¹²

Even though the use of these new psychotropic medications to treat mental illness spread quickly across the country, it appears that Meyers and his trainees continued to perform surgery for those with intractable mental illness until Meyers left SUI in 1963. With his departure, however,

FIG. 4. Portrait of Russell Meyers during his time as chairman of the Division of Neurosurgery at the SUI. Published with permission from the University of Iowa Department of Neurosurgery Archives.

the psychosurgical procedures performed at the University Hospital appeared to cease. Without a neurosurgeon championing the judicious use of psychosurgery as performed by appropriately trained individuals, and with the concurrent rise of pharmacotherapy for mental illness, no further procedures would be performed at SUI over the subsequent 13 years.

Psychosurgery Evolves: More Selective Referrals and More Focal Lesions With Dr. John VanGilder as Chair

In the 1960s, lobotomy gradually fell out of favor as practitioners began to concur that long-term outcomes were not as beneficial as they had initially seemed. Although many patients were “cured” of their aggressive behaviors or psychosis, a significant number of patients correspondingly developed anhedonia due to the large lesions of their frontal lobes. Attention turned instead toward more focal lesions of the fibers connecting the frontal cortex to other parts of the brain, which were anticipated to preserve therapeutic efficacy while reducing the significant side effects seen with lobotomy.⁷

A period of guarded optimism again ensued, particu-

FIG. 5. Postcard depicting the state MHI at Independence. Reproduced from <http://www.kirkbridebuildings.com/buildings/independence/>.

larly as the medical community began to discern that there remained a subset of patients with mental illness refractory even to the new antipsychotic and antidepressant agents.⁶ In 1977, the National Commission for the Protection of Human Subjects of Behavioral and Biomedical Research published a position statement based on “tentative evidence that some forms of psychosurgery can be of significant therapeutic value.”²⁶ Based on available data and “the belief that the misuse of psychosurgery can be prevented by appropriate safeguards,” the commission explicitly did *not* recommend a ban on psychosurgery. It is important to note that the report did comment that psychosurgery was not to be considered “accepted practice” and should be performed “only when it is both medically indicated and when the subject has given informed consent.” Even though some feared this somewhat nebulous recommendation would lead to abuse,² the fields of psychiatry and neurosurgery cautiously moved forward.

This approach of more discriminative lesioning came to the University of Iowa following Dr. John VanGilder’s arrival as chairman of the Division of Neurosurgery in 1976 (Fig. 6). VanGilder performed anterior cingulotomy operations, the goal of which was to selectively remove part of the anterior cingulate cortex to disrupt aberrant connections between the frontal lobes (i.e., the target of the lobotomy) and the thalamus. Patients were selected for the procedure on the basis of severe and intractable mental illness, primarily obsessive-compulsive disorder (OCD). These individuals were referred by their psychiatrist at the University Hospital only after the failure of trials of multiple appropriate medical and psychotherapeutic treatments. Even though a formal screening and approval process did not exist, extreme care was taken to select only those individuals whose condition was refractory to all prior therapies and who might derive some benefit from the “last option” of neurosurgery. As such, we estimate that fewer than 20 of these procedures were performed, all by Dr. VanGilder, in the 25 years that he was operating at the University of Iowa.

Even though the anterior cingulotomy was thought to be superior to transorbital leukotomy—in that it offered

FIG. 6. Portrait of John VanGilder during his time as chairman of the Division of Neurosurgery at the University of Iowa. Published with permission from the University of Iowa Department of Neurosurgery Archives.

improvement in symptoms with reduced off-target effects via more focal lesioning—descriptions of how the technique was performed imply that while the lesions may be more focal, their placement may be of questionable accuracy. A report of the first 5 cases performed at the University of Iowa describes the anterior cingulotomy as a modified leukotomy “severing only the medial 2-3 cm of white matter coursing through the anterior cingulate gyrus; the procedure is thought to act by disrupting the thalamofrontal tract.”²⁵ After bilateral trephination, a suction probe was inserted “near” the anterior cingulate gyrus and was used to remove an approximately 1.5-cm-diameter piece of this tissue. Even though a stereotaxic apparatus could provide some crude probe tip guidance, this practice was not routinely used, and the refined imaging techniques commonly used in the present day did not yet exist.

Of the initial 5 Iowa patients described, all showed some improvement in their symptoms, and none exhibited any long-term measurable postoperative impairment.²⁵ The patients were also specifically noted to have improvement in IQ (preoperative average of 108 to postoperative average of 115) and memory (preoperative memory quotient of 91 to postoperative of 109). These changes were attributed to “better attentiveness” facilitated by a reduction in obsessive thoughts. The authors concluded that psychosurgery was “a safe and effective treatment for an obsessional neurosis that has become debilitating” and stated, “A patient who has suffered for years with disabling obsessive-compulsive behavior that has responded poorly to more conventional therapies has reasonable chances of a favorable outcome with relatively few risks.” Interestingly,

nearly all patients were reported to exhibit a state similar to delirium immediately following the procedure and returned to their baseline cognitive state within a week postoperatively.

As the number of cases slowly grew, surprisingly few complications were noted despite the blind suction probe insertion. Both the neurosurgeon and the referring psychiatrist believed that, in general, all patients had improved symptoms, particularly those related to obsessions. The degree of improvement varied from patient to patient—which may be related to the lack of image guidance during these procedures. According to the referring psychiatrist, none of the patients regretted having the operation.

The Current State of Psychosurgery at Iowa: Neuromodulation as the Modern Approach

As neuromodulation via deep brain stimulator electrodes became an accepted treatment for Parkinson's disease, case reports and small case series emerged describing the use of a similar technology in the treatment of psychiatric illness, specifically OCD.^{9,17} Deep brain stimulation (DBS) offered a comparable ability to focally manipulate neural tissue function while minimizing side effects, and it offered the additional advantage of creating a reversible “lesion” while the device was turned on. The FDA approved a humanitarian device exemption for DBS for severe OCD in 2009 based on a review of data from 26 patients with severe and treatment-resistant disease, and a limited number of DBS unit implantations for OCD were performed at Iowa over the subsequent several years.

Just as the patients undergoing cingulotomy were carefully selected after failure of several conventional therapies, patients selected for DBS suffered from similarly persistent, prolonged, and severe disease. Multiple trials of appropriate medications and behavioral treatments, including cognitive behavioral therapy, had failed to control their symptoms. Some had comorbid mental illnesses such as major depressive disorder. Given the small body of literature supporting the efficacy of DBS for OCD, and the appreciable chance of seeing symptomatic improvement in individuals for whom all else had failed, the physicians caring for these patients thought that the potential benefit of surgery was worth the interventional risks.

Dr. Jeremy Greenlee, who completed his residency training while Dr. VanGilder continued to practice at the University of Iowa, implanted the DBS electrodes, targeting the ventral capsule/ventral striatum. The stimulator settings were programmed by the patient's psychiatrist. To date, fewer than 10 patients have undergone this procedure in part because of the difficulty of obtaining insurance payment for the operation. Early follow-up on these patients was encouraging, demonstrating an improvement in symptoms.¹⁵ More recent reports from the patients' current providers suggested that this beneficial effect had been maintained—the patients' symptoms were less severe, they were no longer homebound, their number of admissions to the psychiatry unit decreased, and so forth. Although the patients do not feel that they have been “cured” of their mental illness, most would say their symptoms and lives have improved since DBS unit implantation.

Conclusions

Neurosurgery as a treatment modality for mental illness has been a part of Iowa's history since the time of Walter Freeman and the frontal lobotomy. As experience with the techniques grew—along with knowledge of their off-target effects—the procedures became increasingly more anatomically and technically refined. In a similar fashion, patient selection was concurrently honed, with surgical intervention reserved for those patients in whom all other therapies had failed. In an effort to provide relief from the psychological suffering of this small group, dedicated psychiatrists and skilled neurosurgeons at the University of Iowa have continued to offer psychosurgery as a treatment option. As long as there are individuals in need, in conjunction with a continued appreciation for the positive outcomes possible with operating, psychosurgery is likely to persist as an important (if minor) aspect of how the University of Iowa provides for patients suffering from severe, intractable mental illness.

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Disclosures

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Author Contributions

Conception and design: Jareczek, Holland, Abel. Acquisition of data: Jareczek, Holland. Analysis and interpretation of data: Jareczek, Holland, Abel. Drafting the article: Jareczek. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Administrative/technical/material support: Walch. Study supervision: Howard, Abel.

Supplemental Information

Videos

Video Abstract. <https://vimeo.com/227409447>.

Correspondence

Francis J. Jareczek, University of Iowa Carver College of Medicine, 375 Newton Rd., Iowa City, IA 52242. email: francis-jareczek@uiowa.edu.