

**The Contemporary Practice of Psychiatric Surgery: Results from a survey of
North American Functional Neurosurgeons**

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Abstract

Background: Deep Brain Stimulation (DBS) for psychiatric indications is becoming increasingly safe and effective. As a result, the treatment of these conditions by neurosurgeons is becoming more widespread and a larger part of the functional neurosurgeons' practice. Given the troubled history of the field and its current renaissance, it is important to evaluate current practices, to serve as a baseline for future comparison, and to gauge changing cultural attitudes towards invasive neuromodulation.

Objectives: The purpose of this study was to obtain a snapshot of the practice of the contemporary functional neurosurgeon engaged in psychiatric surgery. Current practices as well as attitudes towards the direction of the field and its future were also investigated.

Methods: We designed an online survey and distributed it electronically to 299 functional neurosurgeons in North America identified by membership in the World Society for Stereotactic and Functional Neurosurgery. Subsequent statistical and thematic analysis was performed on the data obtained.

Results: Of 299 surveys sent out, 84 were completed (28%). Fifty percent of functional neurosurgeons are currently engaged in some form of psychiatric neurosurgery, with DBS for obsessive-compulsive disorder and depression accounting for most cases. Most surgeons see psychiatric surgery as a growing field,

with multidisciplinary teams and a greater engagement with psychiatry necessary for the expansion of the field. Opinions differed substantially on hypothetical scenarios dealing with surgical cognitive enhancement, with some in favour of it, citing patient autonomy and choice, and others drawing a clear distinction between pathologic and non-pathologic states.

Conclusions: Surgery for psychiatric indications is a growing field in the contemporary functional neurosurgeon's practice. Most neurosurgeons see the field continuing to grow and psychiatric surgery becoming a larger part of their daily practice, with the appropriate ethical and psychiatric oversight. Future editions of this survey and their results, can be used to trace the development and growth of the field as technology and cultural attitudes continue to evolve.

Introduction

The early promise of deep brain stimulation (DBS) for psychiatric indications has spurred enthusiastic interest in the field. The ability to intervene in cortical-subcortical circuits, believed to underlie abnormal thought and behaviour, has changed the way that some, in public and academic circles, view the relationship between the brain and its myriad of functions. As a result, functional neurosurgeons are increasingly being called upon to manage conditions that extend their scope of practice. A systematic examination of that practice has yet to be undertaken, and a survey of contemporary practices at the present time would be valuable for several reasons. First, a snapshot of current functional practices, and of psychiatric surgery practices specifically, would provide a baseline for future comparison as technology advances and cultural values evolve. Any such advances further need to be framed in the appropriate ethical context. Surgery for psychiatric disease remains an ethically loaded topic, and expanding indications and enthusiasm need to be tempered by systematic and rigorous approaches to clinical trials [1,2].

Although there is interest in the field, it is unclear how common psychiatric surgery is in current practice. It is also unclear what direction functional neurosurgeons see psychiatric surgery taking in the future, and whether they believe that the enthusiasm for the field will continue to increase or wane. The ability to intervene in human mood and thought disorders also conjures up possibilities of non-pathological neuromodulation, or cognitive enhancement [3]. Until recently, this has been addressed only in the psychopharmacology literature, with the prospect of targeted surgical interventions for behaviour alteration, being a

far-off, if not fantastical, concept [4]. The embryonic development of brain-machine interface, and the relative success of psychiatric surgery, brings these issues to the public and medical consciousness, but the attitudes of the functional neurosurgeons who will be called upon to address, and ultimately apply, the technology, remains unknown. As such, we sought to obtain a snapshot of the attitudes of current North American functional neurosurgeons towards both psychiatric surgery, in its present and future form, as well as hypothetical future applications of neuromodulation technology.

Methods

A computerized, Internet-based, survey was designed and distributed to North American members of the World Society for Stereotactic and Functional Neurosurgery (WSSFN). The mailing list was obtained from the WSSFN head office, and 299 emails containing links to the survey were sent. Four weeks after the initial email, an additional reminder email was sent out, which was followed by a final reminder two weeks later. Responses to the survey were voluntary and anonymous.

The survey was divided into four sections: basic demographics, functional neurosurgery practice, psychiatric neurosurgery practice and attitudes towards enhancement technology. Each of the clinical sections contained a combination of questions and scenarios, that progressed from commonly encountered topics (depression, OCD) to more hypothetical situations (enhancement). Total time for the survey was estimated at approximately 10-15 minutes, and subsequent responses were accumulated and analyzed off-line by study authors.

Statistical Analysis

Descriptive statistics are reported as frequencies and percentages. Responses from surgeons who practice psychiatric surgery and responses from those who do not were compared and differences in proportions were assessed using the Pearson Chi-Square (X²) statistic. Data were analyzed using SPSS 16.0.

Results

Demographics and General Practice

Eighty-three (83) survey responses were obtained, for a response rate of 28% (83/299). Of 56 participants who commented on their location, 49 (89%) were in the United States and 6 (11%) in Canada (Table 1). Exactly two thirds of respondents indicated they have at least ten years experience in the field with 37% indicating greater than 20 years of operative experience. Further, the proportion of surgeons with formal fellowship training in stereotactic and functional neurosurgery was almost evenly split, with 45% reporting no fellowship, and 55% with a fellowship. The majority of those who obtained a fellowship had obtained it locally, in the country in which they currently practice (77%).

Functional neurosurgery is predominantly practiced at academic, University affiliated hospitals (57/79 or 72% of respondents), with only a small minority practicing independently in the community. Movement disorders and pain disorders represent the vast majority of current practice with 78% and 69% of responders indicating that these indications make up most of their daily practice. Twenty-four

percent (19/78) indicated that psychiatric indications are the most frequently encountered conditions, with epilepsy, being at least some part of their practice in 49% of those surveyed. When further asked which single procedure is performed most commonly in their practice, 56% (42/75) freely volunteered DBS, most commonly for movement disorders. From a technical perspective, 78% (61/78) reported using microelectrode recording to help identify deep brain targets for lesioning or stimulation. When asked for what proportion of their functional practice is DBS utilized, 13% (10/78) indicated they used it exclusively, with well over half of respondents, on the other hand, indicating it accounts for minimal to a moderate proportion of their surgical practice (59%, 46/78).

Psychiatric Neurosurgery

Close to half of respondents indicated that psychiatric neurosurgery is a component of their functional practice (48.8%, 40/82). Henceforth, these respondents will be referred to as psychiatric neurosurgeons, to differentiate them from surgeons reporting no involvement with psychiatric indications. All psychiatric surgeon respondents further reported that psychiatric indications account for a small (<25%) part of their practice (Table 2). Deep brain stimulation is used exclusively in psychiatric patients by 50% of those surveyed, with an additional 30.6% reporting a combination of lesioning and stimulation. The most common conditions referred for surgical treatment are obsessive-compulsive disorder (OCD) (58.3%), depression (36.1%), and Tourette's Syndrome (5.5%). Pre-operative

psychiatric evaluation is almost universal, with 94% of respondents reporting that it is a mandatory component of their practice.

More than three quarters of those who currently perform psychiatric surgery, indicated that it will be a larger component of their practice in the future than it is now (78%). There was also almost a unanimous belief that the volume of psychiatric surgery globally will significantly increase in the years to come (85.7%).

Psychiatric neurosurgeons viewed reluctance on the part of psychiatrists to refer patients, as the number one obstacle impeding more widespread use of surgery for psychiatric indications (50%, 18/36) [Table 3]. Other reasons included cultural stigma surrounding psychiatric disease (39%), the historic misuse of neuromodulation (36%), as well as the perceived experimental nature of currently available treatment options, such as DBS (27.8%). The lack or unavailability of insurance coverage, in the United States in particular, accounted for the majority of volunteered comments.

When surgeons who do not perform psychiatric surgery were asked about the trends of the field, they had a decidedly different answer than those who perform it routinely. Only 30% of respondents, as opposed to 78%, foresaw more psychiatric surgery at their institution in the future, and 50%, as opposed to 86%, believed that global trends for the indication would increase substantially in the years to come (institution: $X^2 = 23.822$, $p < 0.001$; global: $X^2 = 11.217$, $p = 0.011$). Further, these surgeons agreed with those in the other group, that a reluctance of psychiatrists to refer, represented the largest impediment to more widespread use of psychiatric surgery. Virtually no responding surgeons in either group reported an

absence of obstacles to more widespread psychiatric surgery, with lack of appropriate funding and difficulties in establishing neurosurgery-psychiatry alliances, making up the majority of volunteered comments. Perceptions of obstacles to more widespread application of psychiatric surgery between psychiatric and non-psychiatric surgeons were not significantly different ($p > 0.05$).

Nearly all respondents indicated a generally positive view of surgery for psychiatric disease (95%), with two thirds reporting positive views with some reservations (Table 4). Significantly more psychiatric neurosurgeons reported very positive views ($X^2 = 8.288$, $p = 0.040$). The view was less clear when asked to assess the views of other neurosurgeons in their community, with only 38.7% believing those views to be generally positive, with or without minor reservations. Indeed 18.6% indicated that the prevailing attitude was likely negative, with some actively opposing the indication. The view was equally as ambiguous with respect to perceived psychiatrists' attitudes, with no surgeon (0/74) reporting a complete acceptance of the field by their psychiatrist colleagues, and 32.4% believing that psychiatrist in their community are generally not accepting of such procedures, with but few exceptions. Perceptions of psychiatric and non-psychiatric neurosurgeons regarding the acceptance of the neurosurgical community were not significantly different ($p > 0.05$).

Survey participants were asked their opinion regarding the management of hypothetical scenarios in the realm of psychiatric surgery, for indications not yet explored or established. With regards to the validity of proxy consent by a caregiver to allow a presumably safe and effective surgical treatment of severe psychosis,

67.6% of respondents believed that it was ethical to proceed with such consent. When asked about a procedure to dampen sexual impulses in voluntary sex offenders, over half of responding surgeons (56.8%, 42/74) believed such surgery was ethically justified, given a safe and effective procedure in a patient who requests the operation. Sixteen percent believed such surgery would violate the patient's autonomy, with 27% unsure about their beliefs. The views of surgeons who practice psychiatric surgery towards these hypothetical scenarios were not significantly different from those that do not practice psychiatric neurosurgery (all p-values > 0.05)

A large majority of those surveyed (79%) believe that a cultural stigma surrounding psychiatric disease exists in their community. Twenty-five percent further believe that the stigma is such that it impedes appropriate access to care (19/75). Overall, however, 84% (63/75) of respondents believed that sufficient scientific justification exists to continue pursuing neurosurgery for psychiatric indications (Table 5). Significantly more psychiatric neurosurgeons believed sufficient justification existed while significantly more non-psychiatric neurosurgeons were unsure ($X^2 = 9.006$, $p = 0.003$).

Enhancement

Participants were asked several questions and presented with several scenarios regarding surgery for non-pathological states, or cognitive enhancement.

When asked whether it would be ethical to provide surgical memory enhancement to a patient should they request it, 48.6% of respondents (36/74) said

it would not be ethical. The most common reason cited is that neurosurgery should be reserved for the treatment of pathologic states (80%). Other reasons included introducing artificial imbalances into society (35%) as well as interference with patient autonomy (37.5%) and 'natural variation' (30%). An additional scenario proposed altering a maladaptive, non-pathologic trait, such as selfishness or greed, and in such cases 62.5% of respondents (45/72) stated this was not ethical. Again, reserving neurosurgery only for pathological states was stated as the main objection to this (77.6%), but more surgeons in this scenario, as opposed to the memory enhancement scenario (57% vs. 37.5%) referred to personal autonomy as an additional objection. In another hypothetical scenario pertaining to a technology that allows a rapid acquisition of a skill set or knowledge, respondents were evenly split among those in favour (32.9%), opposed (38.4%), or unsure (28.8%). Despite these divisions, when asked to look into the future, and hypothesize about the possibility of surgical cognitive enhancement in 50 years, over half of responding surgeons (54%, 40/74), believed that DBS or other neuromodulation technology will be used for that purpose by then. There were no significant differences in the number psychiatric and non-psychiatric surgeons supporting or opposing surgery for memory enhancement or personality alteration (all p-values > 0.05).

Future Directions

Survey participants were asked several questions regarding the future of their field and the challenges that lay ahead. With regards to their belief about the future of psychiatric neurosurgery, 58.1% of respondents (43/74) reported they

were somewhat optimistic, and that there will be a small but important role for neurosurgeons in the management of these patients. A third (33.8%) saw a major role for neurosurgeons. No survey respondents endorsed a pessimistic view of the future of psychiatric surgery. Supporting this finding, 44.6% (33/74) believed that specific training in psychiatric surgery should be component of any fellowship in stereotactic and functional neurosurgery.

Technology has been intimately linked to functional neurosurgery, and the survey respondents were in agreement that DBS likely represents the greatest advance in the field in the last generation (69.3%, 52/75). Accordingly then, it followed that participants foresaw DBS for psychiatric indications as being the area holding the most promise in the years to come (49.3%), with advances in seizure prediction coming a distant second (17.3%), followed by brain machine interface (13.3%). When asked which conditions they believe surgeons will be helping to treat in 15 years, nearly every listed condition was endorsed, with depression and OCD endorsed by 96%, followed by obesity (62.7%), Alzheimer's Disease (44%), eating disorders (41.3%), coma (34.7%), and schizophrenia (26.7%). Clearly, those surveyed believe the field will grow both in depth and scope in the years to come.

Discussion

Our study canvassed practicing functional neurosurgeons regarding their current surgical practices, with a particular emphasis on psychiatric indications. We found that of those who responded, half of functional surgeons engage in some form of psychiatric surgery, predominantly DBS for depression and OCD, and that a clear

majority is very optimistic about the future of their field. We also attempted to take a snapshot of attitudes towards hypothetical enhancement scenarios, and found that attitudes differed depending on whether traits were being corrected, in the case of maladaptive characteristics, or being supplemented, in the case of memory enhancement, for example.

Surveys of surgical practice have been utilized in the neurosurgical literature to answer specific clinical questions [5-7]. We used a similar approach to evaluate the practice of psychiatric neurosurgery and its future directions. DBS and functional neuroimaging offer opportunities to probe the mechanisms of aberrant circuitry that underlie much of abnormal human behaviour [8]. As technology becomes more sophisticated, surgeons will be increasingly involved in caring for these patients, and in participating in designing clinical trials to evaluate novel treatment strategies. This will take place in the context of two vital points: 1) the troubled history of the field, which casts a shadow over virtually all attempts at and research into neuromodulation, and 2) the rapidly solidifying belief that psychiatric diseases represent an extension of more traditional 'neurologic' conditions; in other words, that dysfunctions of the mind represent dysfunctions of the brain. As cultural values continue to evolve in this direction, it will be the functional neurosurgeon who will be called upon to manage patients with 'organic' brain dysfunction, and address those who see the brain's myriad functions as ultimately modifiable, and hence, eligible for enhancement. By taking a snapshot of current practices as well as general beliefs regarding psychiatric neurosurgery and enhancement, we have provided a baseline for future comparison.

Appropriately, most neurosurgeons engaged in a functional practice full time are affiliated with a University teaching hospital. Such an environment would ensure multidisciplinary collaboration with both their neurology and psychiatry colleagues, and would help secure necessary funding and public/private support for continued research. Several study participants commented on the necessity of a multidisciplinary approach, and this has been echoed in the literature [2,9]. Indeed, every psychiatric surgeon surveyed obtains close psychiatric follow-up pre- and post-operatively for each of their patients. As DBS emerges as the dominant means of neuromodulation, it is worthwhile noting that 50% of psychiatric neurosurgeons still perform some lesioning procedures, with 20% reporting using lesions a majority of the time, and 30% using it occasionally. (Table 2).

Previous work by our group has shown that non-functional neurosurgeons appear to be generally supportive of psychosurgery [10]. Our results confirm this finding in a functional neurosurgery population, and in addition, contain an interesting observation. Those surgeons who are actively engaged in psychosurgery differed substantially from those who aren't, with respect to their attitudes towards the field's future trends, with the former, significantly more than the latter, seeing a large role for psychosurgery in future functional practice. The reason for this is unclear, but is likely related to the enthusiasm for psychiatric surgery of those in the field.

A further observation dealt with views surrounding the idea of enhancement. Surgeons surveyed found it more ethically unsound to 'correct' a perceived personality deficit, such as a maladaptive but non-pathologic traits (e.g. greed), than

to provide an individual with 'supra-normal' abilities, such as memory enhancement. We have previously shown the opposite finding in neurosurgical patients [11]. The latter find it more ethically sound to 'correct' a deficit with a hypothetical surgical intervention, than to provide cognitive enhancement. We hypothesized, that these patients, and presumably others in the population, likely have a 'societal homeostasis' in mind, whereby raising individuals 'up' to meet the 'norm' is more ethically appropriate, and closer in line with traditional medical concepts, than 'elevating' someone above the same norm. It appears that the reverse is true for functional neurosurgeons. Indeed, a clear majority, when asked to indicate the reason for their opposition to enhancement neuromodulation of any kind, indicated that neurosurgery should be reserved only for recognized pathologic states. One reason for the difference between surgeons and patients, could be the proximity to the intervention and to agency over the technology. Surgeons generally only operate on pathology, and may be more sensitized to it, viewing surgical intervention for relatively minor maladaptive deviations in behaviour, for example, as more offensive to the practice of neurosurgery. Of those who believed memory enhancement was ethically sound, 54.5% saw surgical cognitive enhancement as morally and ethically equivalent to cosmetic surgery.

Several themes, however, did emerge throughout the responses to these scenarios and questions that point to the existence of a 'line in the sand' for many surgeons. Most referred to the pathology/non-pathology distinction, and insisted that surgical intervention be reserved, even in the case of memory enhancement, only for those cases where a demonstrated disability was present (Figure 1).

Further emphasis was placed on patient autonomy and the perception that such technology could potentially be usurped for malicious means or applied to unwilling patients. Interestingly, similar concerns were voiced by opponents of psychiatric surgery in the 1970's, leading to a Federally commissioned committee to evaluate the efficacy and safety of the practice [12].

No previous study has examined psychiatric surgery trends in functional neurosurgery, and none has specifically looked inwards, at the attitudes of surgeons towards the practice. Our results point to a strong psychosurgery tradition in contemporary practice, one that most surgeons project will grow in the years to come, in particular for DBS in an expanding array of psychiatric indications.

Limitations

There are several limitations to this study. The first and most obvious is the low response rate (28%). Eligible surgeons received several electronic requests to complete the survey, but there remain several possible reasons why the response rate was so low. These can range from surgeons being away in the summer months, to an unwillingness to complete electronic surveys, to a lack of experience, knowledge or interest in the survey topic and study. We were surprised by the low response rate, as well as concerned that it could represent a disengagement, from the psychiatric surgery debate. Whatever the reason, the relatively low response rate (28%) does limit the generalizability of our results to the larger functional neurosurgery community. The possibility further exists that those surgeons who did not fill out the survey, self-selected themselves out of the study, given they do not

perform these operations on a routine basis, if at all. As a result, surgeons who perform psychiatric surgery may be over-represented. Such biases are common in survey studies, although our results do indicate distinct trends among responses, and further illustrate the existing practice and philosophical divisions in the field. An additional weakness has to do with the fact that the survey canvassed only North American surgeons and excluded surgeons elsewhere. This was a planned approach, as we envisioned this to be a two-stage study, with the next stage involving translating the study to multiple languages, and issuing the survey to functional neurosurgeons globally.

Given the subject matter of the survey, some of the questions and scenarios were highly hypothetical, in particular the questions surrounding cognitive enhancement. The purpose of these questions was not, as some surgeons believed, to assess the role of enhancement in current practice, but rather to gauge the attitudes of current practitioners to such possible future scenarios. Many in the public, bioethics, and surgical domains believe these will be a part of the future neurosurgical landscape [13-15]. Although yes or no responses to complex and multifaceted issues presents some difficulties, we have previously shown that initial 'gut' instincts often guide neurosurgeons attitudes towards novel ideas [10]. These are challenging issues, in other words, that touch on key concepts of patient autonomy, access to care, and consent, and one's attitude towards specific scenarios will often be shaped by personal experience, as well as cultural, and possibly even religious, beliefs.

Conclusions

Psychiatric surgery is becoming an increasingly accepted and widespread component of functional neurosurgery practice. Closer collaboration with psychiatric colleagues and clear delimitations and regulations will aid the field in expanding. In present practice, a clear emphasis should be placed on treatment for clearly pathologic conditions, although there appears to be a robust 'ethical marketplace', given the pre-requisite attention to safety, consent and autonomy, for surgical cognitive enhancement in otherwise healthy individuals. Results from future editions of this and other surveys will be compared to the ones here, to trace the evolution of surgical and societal attitudes towards the role of surgery in the healthy and unhealthy brain.

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References

1. Schlaepfer TE, Fins JJ: Deep brain stimulation and the neuroethics of responsible publishing: when one is not enough. *JAMA* 2010;24;303(8):775-776.
2. Lipsman N, Bernstein M, Lozano AM: Criteria for the ethical conduct of psychiatric neurosurgery clinical trials. *Neurosurg Focus* 2010;29(2):E9
3. DeGrazia D: Enhancement technologies and human identity. *J Med Philos* 2005;30(3):261-83.
4. Sahakian BJ, Morein-Zamir S: Neuroethical issues in cognitive enhancement. *J Psychopharmacol.* 2010 Mar 8. [Epub ahead of print]
5. Gruber TJ, Riemer S, Rozzelle CJ: Pediatric neurosurgical practice patterns designed to prevent cerebrospinal fluid shunt infection. *Pediatr Neurosurg* 2009;45(6):456-60.
6. Connolly ES Jr, Hoh BL, Selden NR, Asher AL, Kondziolka D, Boulis NM, Barker FG 2nd: Clipping versus coiling for ruptured intracranial aneurysms: integrated medical learning at CNS 2007. *Neurosurgery* 2010;66(1):19-34.

7. Scales DC, Riva-Cambrin J, Le TL, Pinto R, Cook DJ, Granton JT: Canadian Critical Care Trials Group. Prophylaxis against venous thromboembolism in neurointensive care patients: survey of Canadian practice. *J Crit Care* 2009;24(2):176-84.
8. Price JL, Drevets WC: Neurocircuitry of mood disorders. *Neuropsychopharmacology* 2010;35(1):192-216.
9. Rabins P, Appleby BS, Brandt J, DeLong MR, Dunn LB, Gabriëls L, Greenberg BD, Haber SN, Holtzheimer PE 3rd, Mari Z, Mayberg HS, McCann E, Mink SP, Rasmussen S, Schlaepfer TE, Vawter DE, Vitek JL, Walkup J, Mathews DJ: Scientific and ethical issues related to deep brain stimulation for disorders of mood, behavior, and thought. *Arch Gen Psychiatry* 2009;66(9):931-7.
10. Mendelsohn D, Lipsman N, Bernstein M. Neurosurgeons' perspectives on psychosurgery and neuroenhancement: a qualitative study at one center. *J Neurosurg*. 2010 Jun 4. [Epub ahead of print]
11. Lipsman N, Zener R, Bernstein M: Personal identity, enhancement and neurosurgery: a qualitative study in applied neuroethics. *Bioethics* 2009;23(6):375-83.

12. Fins JJ: From psychosurgery to neuromodulation and palliation: history's lessons for the ethical conduct and regulation of neuropsychiatric research. *Neurosurg Clin N Am* 2003;14(2):303-319.
13. Northoff G: What is neuroethics? Empirical and theoretical neuroethics. *Curr Opin Psychiatry* 2009;22(6):565-569.
14. Demetriades AK, Demetriades CK, Watts C, Ashkan K: Brain-machine interface: The challenge of neuroethics. *Surgeon* 2010;8(5):267-269
15. Gillett GR: The subjective brain, identity, and neuroethics. *Am J Bioeth* 2009;9(9):5-13.