Clinical Case Report

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Long-term Results of Stereotactic Radiofrequency Surgery for Aggressive Behavioral in Obsessive-Compulsive Adolescent: A 10-Year Follow-up Case Report

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Introduction: Aggressive and self-injurious behaviors associated with obsessive-compulsive disorder in patients with intellectual disability represent a major therapeutic challenge, particularly in cases refractory to pharmacological and behavioral treatment. In this context, stereotactic neurosurgery has been considered a last-resort option, targeting limbic and paralimbic circuits involved in emotional and behavioral regulation.

Case Report: We report the case of a 17-year-old male with pharmacological resistant obsessive-compulsive disorder and severe mental retardation, with a 9-year history of refractory aggressive behavior, who underwent stereotactic neurosurgical intervention in 2006. Preoperatively, the patient exhibited high levels of aggression (MOAS score: 31). Postoperatively, there was a complete and sustained remission of aggressive episodes, with MOAS scores of 0 at all follow-up intervals up to 10 years. The patient also experienced marked improvement in obsessive-compulsive symptoms, reduction in psychotropic medications, and significant enhancement in attention, concentration, quality of life, and family satisfaction. One wound infection was reported postoperatively, with no lasting adverse effects.

Conclusion: This case highlights the potential for stereotactic lesioning to induce profound and durable behavioral improvements in select patients with treatment-refractory aggression.

Keywords: Aggressive behavior, Obsessive-compulsive disorder, Stereotactic Ablation, Radiofrequency

INTRODUCTION

Aggressive and self-injurious behaviors in patients with intellectual disability associated with OCD pose significant therapeutic challenges, especially when resistant to pharmacological and behavioral treatments [1].

Stereotactic neurosurgical procedures targeting specific brain circuits have been explored as a last-resort option in such cases [2].

The current targets for stereotactic neuromodulation and/or ablation involve the modern concept of Papez limbic system regions of hippocampus, amygdala, fornix, hypothalamus, septal nuclei, mammillary bodies, ventral striatum (including the nucleus accumbens), dorsomedial and anterior thalamic nuclei, the cingulate gyrus (prefrontal regions, and the orbitofrontal cortex, along with paralimbic areas such as the insula and parahippocampal gyrus [3-5].

We describe the long-term clinical outcomes of combined stereotactic ablative surgery targeting the anterior cingulate, subcaudate tract, anterior limb of the internal capsule, and amygdala in a patient with severe, treatment-resistant obsessive-compulsive disorder, aggression and intellectual disability, and evaluate the potential benefits and safety of this multimodal surgical approach for individuals with refractory neuropsychiatric disorders.

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CASE REPORT

A 17-year-old male presenting with severe intellectual disability, associated with OCD and severe aggressive behavior for over 9 years, refractory to available conservative treatments. The patient lived with very limited contact with others in his own home and had infrequent social interactions, usually needing to be anesthetized for dental visits. He was unable to go to the office, so a home visit was performed. The brain MRI was normal. The patient was evaluated by two independent psychiatrists, who confirmed treatment resistance and the indication for surgery. Neuropsychological testing was not possible due to the mental disability and severe aggressiveness. Preoperative assessment using the Modified Overt Aggression Scale (MOAS) yielded a score of 31, reflecting severe and frequent aggression.

Informed consent was obtained from the patient's guardian. Approval was received from the Psychiatry Committee of the Regional Medical Council and the Health Science Center Ethics Committee at the Federal University of Espírito Santo under 89338818.2.0000.5060 / 2.916.981 on September 25, 2018.

He underwent a standardized bilateral stereotactic ablative procedure, including anterior cingulotomy, subcaudate tractotomy, anterior capsulotomy, and amygdalotomy. These procedures were performed under general anesthesia using a classic bilateral frontal approach trajectory, with two burr holes. The TB-09 Micromar stereotactic frame (Micromar, São Paulo, Brazil) and radiofrequency thermocoagulation (Micromar, São Paulo, Brazil) at a temperature of 80°C for 60 seconds were used. Target coordinates were determined based on preoperative magnetic resonance imaging (MRI) fused with computed tomography (CT) using stereotactic planning software (MNPS, Mevis, São Paulo, Brazil), along with the Schaltenbrand and Wahren Atlas and Talairach Atlas, to ensure precise localization of the targets. The reference coordinates used for targets were: a) Anterior Cingulotomy: 7–10 mm lateral to the midline, 30 mm posterior to the anterior border of the frontal horn of the lateral ventricle, and 5–10 mm above the roof of the lateral ventricle; b) Subcaudate Tractotomy: 15 mm lateral to the midline, 10–15 mm above the sphenoidal plane, and 12 mm anterior to the tuberculum sellae; c) Anterior Capsulotomy: 17 mm lateral to the midline, 10 mm anterior to the anterior commissure, and 8 mm above the intercommissural line; d) Amygdalotomy: 5 mm anterior and lateral to the tip of the temporal horn.

The postoperative CT scan, taken one day after surgery, showed the lesions in a satisfactory position. MRI three months later confirms these findings (Figure 1). He presented a wound infection, which was successfully treated. Following surgery, the patient exhibited a rapid and complete remission of aggressive episodes. MOAS scores decreased from 31 preoperatively to 0 at all follow-up assessments conducted at 1, 3, 6, 12, 36, 60, and 120 months postoperatively, representing sustained suppression of aggressive behavior throughout the 10-year follow-up period (Figure 2).

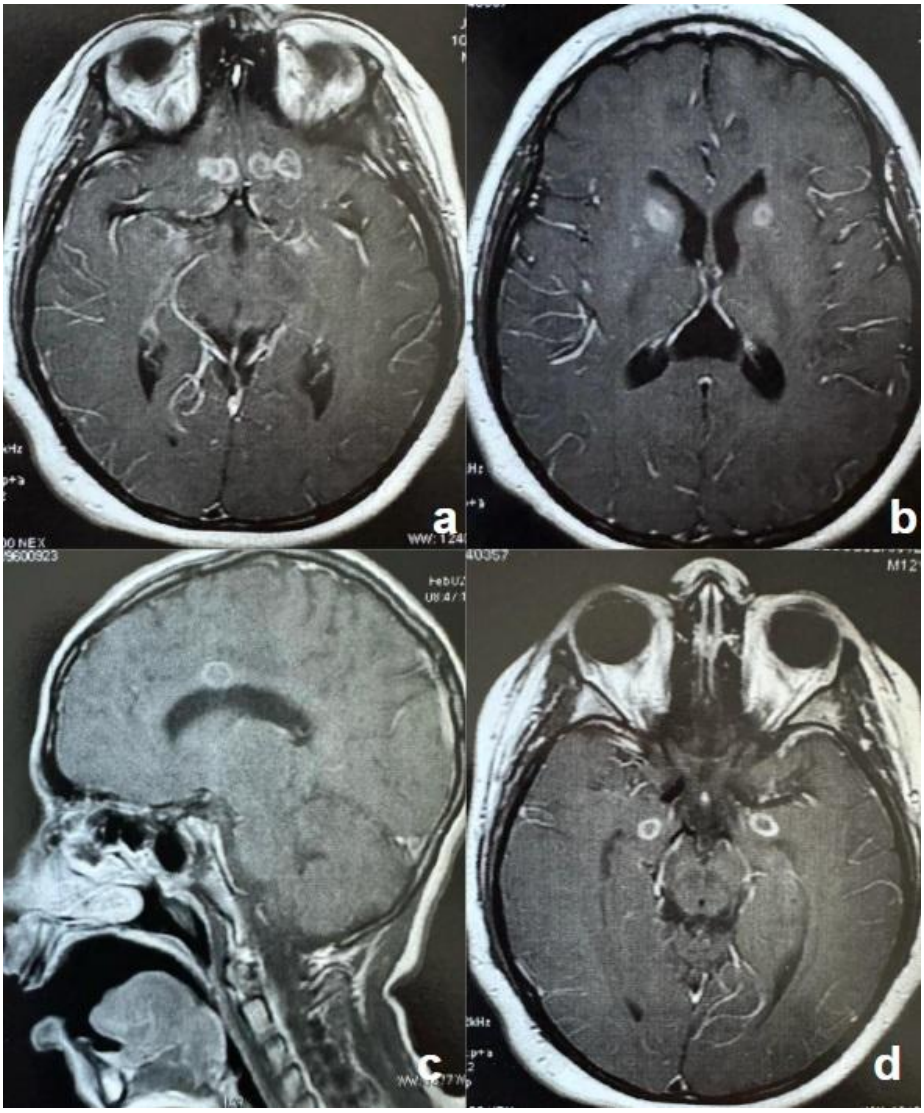

Figure 1. Postoperative MRI showing the lesions after bilateral subcaudate tractotomy (a), anterior capsulotomy (b), anterior cingulotomy (c), amygdalotomy (d).

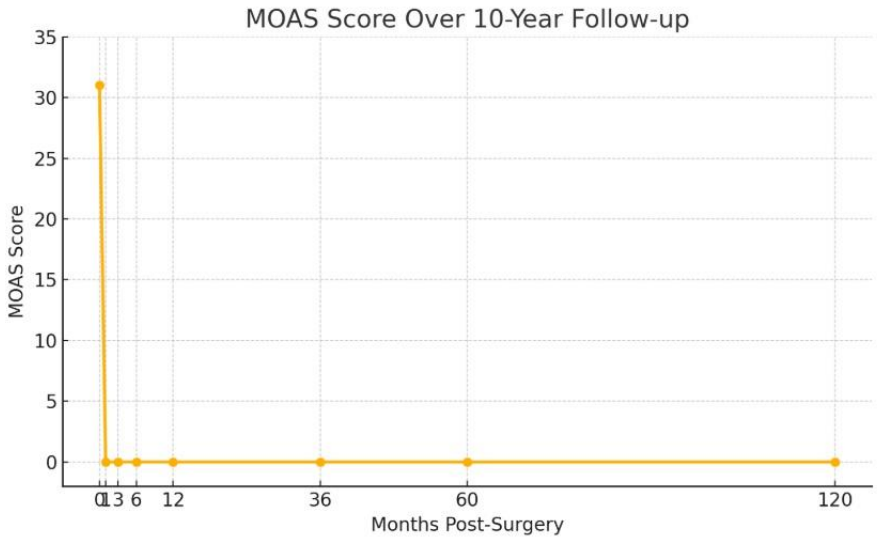

Figure 2. Line plot showing MOAS trajectories at preoperative, 1, 3, 6, and 12 months after stereotactic ablative surgery.

In addition to resolving aggressive symptoms, there was a significant improvement in obsessive-compulsive behaviors, as reported by caregivers. Psychotropic medication use was decreased after surgery. Family feedback consistently rated the patient's quality of life and social functioning as "excellent" following the procedure. Notably, the patient showed improved attention and concentration, which contributed to better daily functioning. He was able to go out and stroll in the park with his mother near their house. A summary of the clinical course and outcomes is provided in Table 1. Collectively, these findings illustrate the dramatic and sustained benefit of stereotactic lesioning for the management of severe, refractory aggression in this patient, with additional improvements in obsessive-compulsive symptoms, cognition, and quality of life.

Table 1. Summary of the clinical course and outcomes

OUTCOME	PREOPERATIVE	POSTOPERATIVE (1–120 MONTHS)
MOAS Score	31	0
Obsessive-compulsive Symptoms	Present	Improved
Medication Use	Multiple	Reduced
Quality of Life	Poor	Excellent
Family Satisfaction	Poor	Excellent
Complications	-	Wound infection (resolved)
Cognitive/Behavioral Status	Impaired	Improved attention/concentration

DISCUSSION

Although aggressive behavior is part of human being's nature, when it is maladaptive, excessive, and persistent, it becomes a problem, representing the most frequent reasons for mental health referrals among children and adolescents, and leading to high healthcare costs and significant social and economic issues [6].

It is highly prevalent among psychiatric patients and frequently leads to institutionalization or severe disruptions in social and familial interactions [7]. Although aggressive behavior associated with psychiatric disorders is generally managed through pharmacological and behavioral interventions[8], these approaches may be insufficient in some instances, particularly among individuals with severe intellectual disability [9]. For patients with treatment-refractory aggression, surgical intervention may therefore be considered.

Neurosurgical interventions for psychiatric disorders entail the targeted modification of specific neural circuits to ameliorate maladaptive behaviors, utilizing approaches such as ablative lesioning or neuromodulation [10]. Always involving a multidisciplinary team of psychiatrists, neuropsychologists, and neurosurgeons based on rigorous protocol assisted by the Ethical Council. Surgical candidates depend on the duration of refractoriness and severity of functional impairment.

The subcaudate tractotomy has been utilized in the management of affective disorders, obsessive-compulsive disorder (OCD), and chronic anxiety. Clinical observations indicate improvements in both depressive and manic symptoms among individuals with bipolar disorder. In Knight's 1964 series involving 249 patients, approximately 34% exhibited a clinical response within the first year of treatment [11]. Göktepe and colleagues later reported beneficial outcomes in 60% of patients with depression and 50% with OCD [12]. Reported adverse effects include seizures, weight gain, and episodes of transient confusion.

Anterior capsulotomy, initially described by Talairach and Leksell in 1949, is primarily performed for OCD [13,14]. Mindus et al. noted marked symptom improvements in patients with OCD following this intervention [15]. However, transient confusion, behavioral disinhibition, urinary incontinence, focal neurological deficits, and seizures have been documented as potential complications.

Narabayashi and co-authors (1963) presented a clinical series of 60 individuals undergoing stereotactic bilateral lesions of the lateral nucleus of the amygdala for severe aggressive behavior [16]. Although this approach showed promise, postoperative issues such as memory disturbance, sexual disinhibition, fatigue, and seizures were observed. A literature review by Goiveia et al. identified 27 studies on amygdalotomy or surgery for aggression, comprising 1,217 patients, with an average improvement rate of 69.5% [5]. However, direct comparisons should be approached cautiously due to heterogeneity in techniques, targets, assessment criteria, and adjunct procedures.

Vilela Filho (2019) described high rates of failure and recurrence following bilateral amygdalotomy for primary intellectual and adaptive disabilities (PIA) [17]. Functional neuroimaging studies prompted the adoption of bilateral anterior cingulotomy as a subsequent intervention [18].

Ballantine's introduction of anterior cingulotomy in 1987 yielded reported response rates of 41% for major depressive disorder, 50% for anxiety disorders, and 25% for OCD [19]. Spangler et al. later documented a 38% response rate, noting that a considerable number of patients required repeat procedures [20].

Kelly (1973) advocated for the combination of anterior cingulotomy with subcaudate tractotomy—termed limbic leucotomy [21]. Mitchell-Heggs and collaborators subsequently reported improvement rates of 89% for OCD, 66% for anxiety disorders, and 78% for depression. However, side effects such as seizures, urinary incontinence, lethargy, and personality changes were noted [22].

We selected a multi-target approach of four distinct regions. Our results indicate that simultaneous stereotactic lesions of the anterior cingulate, subcaudate tract, anterior limb of the internal capsule, and amygdala produce marked reductions in treatment-resistant aggression with OCD and contribute to substantial improvements in quality of life for both patients and their caregivers, without increasing morbidity or mortality.

Deep brain stimulation (DBS) has demonstrated promising results in managing behavioral disturbances [23-27]. However, this approach is linked to significantly higher costs and requires more intensive follow-up [28]. Patients with severe intellectual disabilities, especially those exhibiting self-injurious behavior, are more vulnerable to DBS-related complications such as infection, skin breakdown, and hardware failure (e.g., lead fracture or disconnection). In this context, ablative interventions remain an important option.

CONCLUSION

Stereotactic neurosurgery may be a valuable option for select patients with intractable aggression, resulting in durable improvement in both clinical and social domains.

DISCLOSURES

ETHICAL APPROVAL

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the local Ethics Committee: Health Science Center Ethics Committee at the Federal University of Espírito Santo under 89338818.2.0000.5060 / 2.916.981 on September 25, 2018.

CONSENT TO PARTICIPATE

The patient gave consent to use his information and images for publication.

CONFLICT OF INTEREST

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper

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ARTIFICIAL INTELLIGENCE

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CONTRIBUTIONS

Walter Fagundes: Investigation, Methodology , Supervision, Writing – original draft
Rodolpho Albuquerque Souza: Investigation , Methodology , Writing – review & editing
Ricardo Santos de Oliveira: Investigation , Methodology Project administration
Sergio Dantas: Investigation, Methodology, Writing – review & editing

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