

## EVIDENCE-BASED INTERVENTIONS FOR TOURETTE SYNDROME: AN UPDATED REVIEW OF PHARMACOLOGICAL, BEHAVIORAL AND NON- PHARMACOLOGICAL THERAPIES

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**Abstract: Objective:** To describe therapeutic interventions for the treatment of TS, covering both pharmacological and non-pharmacological approaches. The aim is to identify the most effective interventions in reducing tics and improving patients' quality of life. **Methodology:** Literature review in the PubMed database. After applying the inclusion criteria, 25 articles were selected to compose the study. The review was conducted based on the PVO strategy, which involved analyzing the population or research problem, the variables involved and the expected outcome. **Results:** Pharmacological interventions, especially those that act on the dopaminergic system, proved to be effective in reducing tics in the short term. However, non-pharmacological treatment has gained prominence due to the side effects associated with drug interventions. It is up to the doctor and the patient to identify the most appropriate approach for each case, considering the advantages and disadvantages of each treatment. **Final considerations:** Both non-pharmacological and pharmacological treatment are effective in managing TS. However, some patients may not show satisfactory progress with these interventions, especially deep brain stimulation.

**Keywords:** Tourette's Syndrome, Pharmacological Treatment, Non-Pharmacological Treatment, Deep Brain Stimulation.

## INTRODUCTION

Tourette Syndrome (TS) is a neurological condition of neurodevelopment characterized by motor and phonic tics, of non-secondary origin and persistent for more than 12 months before the age of 18, according to the classification of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (BILLNITZER A.; JANKOVIC J., 2020). Commonly, the individualized therapeutic approach for TS involves a combination

of modalities, from behavioral therapies, to pharmacological interventions, the use of botulinum toxin and, in more severe situations, surgical procedures, such as deep brain stimulation (JANKOVIC J., 2020).

TS affects 0.3% to 1% of the general population and its prevalence is influenced by factors such as sex and age. The condition is more common in men, in a ratio ranging from 3:1 to 4.3:1 in relation to women, usually developing around 5 years of age (BILLNITZER A.; JANKOVIC J., 2020; PANDEY S.; DASH D., 2019). The association of TS with psychiatric and behavioral comorbidities is notorious, among which stand out Anxiety Disorders, Attention Deficit Hyperactivity Disorder (ADHD), present in 54.3% of cases, and Obsessive-Compulsive Disorder, with a prevalence of 50% ( JANKOVIC J., 2020; FREY J.; MALATY I.A., 2022; PANDEY S.; DASH D., 2019).

The repercussions of TS extend beyond tics, causing muscle fatigue, pain and impairment of patients' social and academic relationships, favoring the occurrence of bullying and depression situations (SEIDEMAN M.F.; SEIDEMAN T.A., 2020; FREY J.; MALATY I.A., 2022). Considering the complexity of TS, it is fundamental that the therapeutic approach be multidisciplinary, also contemplating the associated comorbidities, in order to achieve better results.

In this narrative review, we seek to investigate current therapeutic interventions based on evidence that are more effective and safer in the management of clinical manifestations of TS, with emphasis on reducing the severity of characteristic tics. The purpose is to examine recent clinical and experimental studies, assessing the efficacy and safety of pharmacological, behavioral and non-pharmacological therapies, comparing different treatment modalities, and identifying indications and contraindications

for each approach. Finally, it is intended to highlight promising areas for future research and development in the field of neurology, specifically aimed at improving complex tics in Tourette Syndrome.

## METHODOLOGY

This is a bibliographic review developed following the criteria of the PVO strategy, an acronym that represents: population or research problem, variables and outcome. Used for the development of the research through its guiding question: "Which evidence-based interventions, including pharmacological, behavioral and non-pharmacological therapies, are more effective and safer to improve the severe clinical manifestations of Tourette Syndrome in diagnosed patients?". In this sense, according to the parameters mentioned above, the population or problem of this research refers to the population of patients diagnosed with Tourette's Syndrome, the variables refer to pharmacological, behavioral and non-pharmacological interventions, and the outcome would be the best prognosis. The searches were carried out through searches in the PubMed Central (PMC) databases. The following descriptors were used in combination with the Boolean term "AND": Tourette Syndrome/ *Tourette Syndrome*, Tratamento/ *Treatment*, Farmacológico/ *Pharmacological*, Não Pharmacological / *Non Pharmacological*, and Surgical / *Surgical*. From this search, 105 articles were found, subsequently submitted to the selection criteria. Inclusion criteria were: articles in English; published in the period from 2017 to 2023 and which addressed the themes proposed for this research, studies of the literature review type, systematic review, meta-analysis, review, clinical trial, and observational studies, available in full. Exclusion criteria were: duplicate articles, available in summary form, which did not

directly address the studied proposal and which did not meet the other inclusion criteria. After applying the inclusion and exclusion criteria, 25 studies were selected to compose the collection of this study.

## **RESULTS**

### **TOURETTE'S SYNDROME: PATHOPHYSIOLOGY, CLINIC AND DIAGNOSIS**

Tourette's Syndrome is a neurological disorder characterized by involuntary tics - abrupt, repetitive and non-rhythmic manifestations of movements or sounds that the individual is unable to completely suppress. Named after the French physician Georges Gilles de la Tourette, who first delineated the condition in 1885, it features two main classifications for tics: motor and phonic, which are subdivided into simple and complex. Tics manifest as stereotyped body movements, recurrent and uncomfortable, which can affect almost any muscle in the body. When they affect the muscles responsible for breathing, speaking and swallowing, these tics can produce sounds and are classified as phonics. Uncomfortable sensations, called premonitory impulses, can anticipate the occurrence of tics and are temporarily softened by them (MARTINO D.; PRINGSHEIM T., 2017).

Factors determining the severity of tics include psychosocial stress, which can correlate with levels of anxiety and fatigue. There is seasonal fluctuation of tics and individuals under 18 years of age, who have tics for a period of 1 year or who have not ceased for more than 3 months, can be evaluated as possible carriers of the syndrome (BILLNITZER A.; JANKOVIC J., 2020).

The pathophysiological mechanism of Tourette's Syndrome primarily involves alterations in the corticobasal loop and ganglio-thalamo-cortical ganglion (CBGTC),

which make up a system of neural circuits in the brain. The loop involves connections between the cortex, basal ganglia, the thalamus and back to the cortex. The circuits represent a dynamic network of reverberant inhibitory and excitatory influences, so as to provide multiple potential sites of influence. In the disease, the action of the essential individual components of these pathways can explain in detail the symptomatological profile of the disease and its consequences. The disorder affects integrated neurotransmission systems and nerve circuits. Locations of possible physiological abnormalities in the syndrome may include: direct and indirect motor pathways, alteration within some CBGTC-like specific neurotransmitter region, and finally, the concept of a complex circuit, where failure at any point along the pathway can alter cortical excitability and allow "tics" (GROTH C., 2018). Regarding the cortex, there is a widely discussed and evidenced relationship between this brain region and tics, in addition to neuropsychiatric comorbidities, inhibitory cognitive deficits, obsessive compulsive disorders, attention deficit hyperactivity disorder, anxiety, bipolarity and disruptive behavior in general (GROTH C., 2018).

As for the basal ganglia, alterations in this region may be associated with movement disorders, as the disruption of the GABA/ glutamate balance within the striatum can cause these nervous "tic" behaviors. Finally, other potential regions can originate or enhance the disturbance. There are discussions and arguments about the involvement of tonsils, hippocampus, ventral striatum, thalamus and cerebellum (AUGUSTINE F.; SINGER H.S., 2018).

Diagnosis of tics usually requires a combination of historical information and direct observation of characteristic motor behaviors. Health professionals, such as doctors or psychologists, often assess the

symptoms reported by the patient and also observe their condition over time (MARTINO D.; PRINGSHEIM T., 2017). In addition to this observation, the diagnosis is based on the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) or the International Classification of Diseases (ICD-11). In the DSM-5, TS is classified as a spectrum of tic disorders, being considered the most severe. In ICD-11, TS was removed from the category of emotional disorders and classified as a movement disorder. Both criteria require the presence of multiple motor tics and at least one phonic tic (although not necessarily at the same time) for a period of 12 months, starting before age 18 years. The tics must occur several times a day and nearly every day, with no tic-free period lasting more than three consecutive months. When only motor tics or phonic tics are present (but not both), the person is considered to have persistent or chronic tic disorders, rather than Tourette Syndrome (CHOU C. Y. et al., 2023).

## PHARMACOLOGICAL TREATMENT

The prevailing theory about the neurotransmitter abnormality underlying Tourette's Syndrome mainly involves the dopaminergic system, although imbalances in the noradrenergic, serotonergic, cholinergic, GABAergic and glutamatergic systems have also been identified (JANKOVIC J., 2020). Concurring with this view, Augustine F. and Singer H.S. (2018), and Badenoch J. and Cavanna A.E. (2020) suggest that the current practice of pharmacotherapy in Tourette is diverse and poorly understood.

The first record of the use of drugs for the treatment of tics in Tourette Syndrome (TS) dates back to 1961, with the typical antipsychotic haloperidol being the agent used (NOMURA Y., 2022). Official approval for the use of haloperidol in TS by the Food and Drug Administration (FDA) occurred in 1969.

Later, pimozide, another typical antipsychotic, and aripiprazole, an atypical antipsychotic, also received approval (ROESSNER V. ET AL., 2022). Currently, these three drugs are the only ones approved by the FDA for use in TS, with efficacy proven by several studies (JANKOVIC J., 2020).

Although antidopaminergic drugs are the most supported by the literature (JANKOVIC J., 2020), typical antipsychotics, such as haloperidol and pimozide, have poorly tolerable side effect profiles. These effects include extrapyramidal disorders such as akathisia, acute dystonia, and parkinsonism; metabolic disorders such as type 2 diabetes mellitus, weight gain, changes in lipid profile and blood pressure; in addition to QT interval prolongation, hyperprolactinemia, behavioral disturbances and tardive dyskinesia. In view of these considerations and considering the lack of evidence demonstrating differences in efficacy between antipsychotics (ARTUKOGLU B. B.; BLOCH M. H., 2019), current recommendations prioritize the use of atypical antipsychotics, such as aripiprazole, tiapride and risperidone, which have a more tolerable profile of adverse effects (ROESSNER V. ET AL., 2022).

In addition to typical and atypical antipsychotics, other classes of drugs used include anticonvulsants (topiramate), alpha-adrenergic agonists (clonidine and guanfacine), and vesicular monoamine transporter type 2 (VMAT-2) inhibitors, such as tetrabenzine. Topiramate, a broad-spectrum anticonvulsant that increases GABAergic activity, demonstrated a superior effect to placebo in reducing tics in a randomized trial. Clonidine and guanfacine were shown to be more effective in suppressing tics than placebo, in addition to improving symptoms of attention deficit hyperactivity disorder (ADHD) in patients with comorbid ADHD. The efficacy of tetrabenzine in TS has not yet

been robustly proven, but it has been shown to be beneficial in reducing tics in open studies (AUGUSTINE F.; SINGER H.S., 2018), and, as Jankovic J. (2020) notes, has been used in other hyperkinetic disorders for improving symptoms without causing tardive dyskinesia.

According to Nomura Y. (2022), factors that must be considered when choosing pharmacotherapy in TS include the severity and age of onset of tics, the current age of patients and the presence of comorbidities. Badenoch J. and Cavanna A.E. (2020) noted a preference for antidopaminergic medications over alpha-2-agonists in patients with comorbid obsessive-compulsive disorder (OCD) symptoms, an observation that is in line with a previous study that demonstrated improvement of OCD symptoms and behavioral comorbidities with the use of aripiprazole.

Other drugs already considered for the treatment of tics include dopamine agonists (pergolide, pramipexole), which have been shown to be ineffective and potentially cause serious side effects; drugs that act on the cholinergic system, including cholinergic precursors and anticholinergic agents, with inconsistent results; selective serotonin reuptake inhibitors, which have not been shown to be effective in suppressing tics; glutamate modulators (d-serine, riluzole), which were ineffective; and a GABA agonist (baclofen), which has shown divergent outcomes in the literature (AUGUSTINE F.; SINGER H.S., 2018). According to Artukoglu B. B. and Bloch M. H. (2019), cannabinoid-based treatment appears as a promising therapy in some case reports, but its effectiveness has not yet been satisfactorily proven by randomized placebo-controlled studies, and there is still not enough evidence about its long-term side effects, and more research is needed.

The European Guidelines for Tourette

Syndrome and other tic disorders, published by Roessner V. et al. (2022), recognize the lack of studies in the current literature that establish with strong levels of confidence an adequate pharmacotherapy for tics, with this level of evidence, for the time being, reserved for behavioral interventions. Artukoglu B. B. and Bloch M. H. (2019) identify the difficulty of isolating possible confounding factors that may influence the improvement or worsening of tics — such as differences in the intensity of tics between patients of different age groups, or even the evolution of the disorder over the course of each patient's life—as limitations to establishing clear efficacy profiles for currently used drugs.

However, well-indicated drug therapy has proven efficacy in reducing tics in Tourette Syndrome in the short term. The current recommendations of Roessner V. et al. (2022) favor the use of aripiprazole, tiapride, and risperidone for TS, and clonidine and guanfacine for TS with comorbid ADHD.

## NON-PHARMACOLOGICAL TREATMENT

The non-pharmacological approach to the treatment of Tourette's Syndrome has gained strength, given the considerable occurrence of side effects from drug treatment (EAPEN V. et al., 2022). In this sense, both the American Academy of Neurology and the European Society for the Study of Tourette Syndrome support this recommendation, reiterating the efficacy and safety of this alternative compared to the use of medication. The non-pharmacological strategy is distinguished by the way the patient is managed, either by self-regulation, highlighting cognitive behavioral therapy; or by external stimulation, in which deep brain stimulation is predominant (SUH H-W. et al., 2021).

With regard to self-regulation, behavioral therapy emerges as the standard treatment for

tics, with emphasis on habit reversal therapy, widely adopted in patients (RIZWAN M. et al., 2022). Although the complete understanding of the neurophysiology of this approach still requires further studies (EAPEN V. et al., 2022), it is known that the mechanism of action involves, initially, training the patient to recognize the tic and, subsequently, to associate it with a competitive response, preventing the occurrence of involuntary movement. The success of this last step requires that the muscles being exercised are the same ones involved in the tic, allowing the patient to use this strategy to prevent the tic manifestation safely, after practicing at home (ANDRÉN P. et al., 2021).

Regarding patients refractory to more conservative therapies, whose percentage is small, deep brain stimulation is presented as an alternative (FREY J.; MALATY I.A., 2022). In this procedure, electrodes are implanted in the brain, allowing anodic and cathodic stimulation to be performed, which increases and reduces cortical excitability, respectively. Such an intervention results in improvements, especially regarding the severity of the tic. However, studies, so far, have not provided homogeneous results, indicating the need for further investigations to reach robust evidence (FREY J.; MALATY I.A., 2022).

Recent studies converge to the recommendation of behavioral therapy as the first-line non-pharmacological treatment, both for its effectiveness and the advantage over pharmacological treatment, especially with regard to side effects. In addition to habit reversal therapy, other strategies can be adopted, such as exposure and response prevention, in which patients are instructed to tolerate premonitory impulses for a prolonged period, with the aim of reducing tics (RIZWAN M. et al, 2022), and psychoeducation, which still lacks robust evidence regarding its implementation method (ANDRÉN P. et

al., 2021). It is important, however, that the physician takes into account the individuality of each case and thus chooses the best course of action within current possibilities.

## DEEP BRAIN STIMULATION

Individuals with Tourette Syndrome have pharmacological and behavioral therapy as the main treatment methods (MAHAJAN U. V. et al., 2020). However, not all patients benefit from these therapies, either due to poor adherence, unpleasant side effects or limited response to medication, resulting in persistent tics and being classified as refractory, which significantly impacts quality of life. In such cases, deep brain stimulation is considered an additional therapeutic option (CAPPON D. et al., 2019; SZEJKO N. et al., 2022; KRACK P. et al., 2019).

The procedure involves the implantation of electrodes in specific areas of the brain, responsible for tic control. a high-frequency focal stimulus (CASAGRANDE S.C.B. et al., 2019). It is a safe procedure; despite this, it still represents an approach that requires neurosurgical procedures and, consequently, risks, such as hemorrhages and postoperative infections (DYKE K. et al., 2021).

Surgical treatment with deep brain stimulation (DBS) is considered an option for patients with severe, treatment-refractory tics. However, the evidence available for its use is still limited and based on few randomized clinical trials, which highlights the urgent need for further studies on the subject (CAPPON D. et al., 2019; SZEJKO N. et al., 2022). Despite this, carefully selected patients show significant improvement, with a moderate safety profile. This therapy is recommended for patients who have severe motor and vocal tics that do not respond to behavioral interventions and the use of three pharmacological classes, and who suffer an intense loss in their quality of life (SZEJKO

N. et al., 2022). Therapy with DBS can be offered in specialized centers after evaluation of the patient by a multidisciplinary team, being essential the treatment of psychiatric comorbidities before the surgical approach and the minimum stability of 6 months (ANDRÉN P. et al., 2021).

However, DBS treatment faces several challenges, including proper patient selection, ethical issues involved in pediatric treatment, and optimization of treatment. The benefits of performing the procedure may vary depending on the brain area stimulated. It is evident that deep brain stimulation significantly improves severe tics, but results regarding improvement of symptoms of depression and obsessive-compulsive disorder may vary (BALDERMANN J.C. et al., 2021). However, it is important to emphasize that this therapy is not free of adverse effects, which may be related to the surgery, the hardware used and the effects of stimulation. These adverse effects may include electrode tip hematoma, intracranial hemorrhage, poor wound healing, weight loss, mood swings, sexual behavior changes, psychosis, depression, hypomania, and visual disturbances (XU W. et al., 2020).

attention deficit hyperactivity disorder (ADHD); behavioral therapy, such as habit reversal therapy and exposure and response prevention; and deep brain stimulation (DBS), being indicated for more severe cases in which there is no satisfactory response to drug and behavioral treatments. However, the need for more research on pharmacotherapy, psychoeducation and DBS is highlighted, in order to achieve the best results safely in each treatment modality.

## **FINAL CONSIDERATIONS**

Tourette's Syndrome (TS) is a neurological disorder that is characterized by the presence of involuntary motor and phonic tics, which can cause muscle fatigue, pain and negatively impact the social and academic relationships of affected individuals. The treatment of TS involves pharmacological, behavioral and non-pharmacological approaches. It is inferred, through scientific literature analysis, that the most effective and safe interventions to improve TS symptoms include: the use of atypical antipsychotics (such as aripiprazole, tiapride and risperidone) and alpha adrenergic agonists (such as clonidine and guanfacine), for cases in which TS is associated with



## REFERENCES

- ANDRÉN, P. et al. European clinical guidelines for Tourette syndrome and other tic disorders—Version 2.0. Part II: Psychological interventions. **European child & adolescent psychiatry**, v. 31, n. 3, p. 403-423, 2022.
- ARTUKOGLU, B. B.; BLOCH, M. H. The potential of cannabinoid-based treatments in Tourette syndrome. **CNS drugs**, v. 33, p. 417-430, 2019.
- AUGUSTINE, F.; SINGER, H. S. Merging the Pathophysiology and Pharmacotherapy of Tics. **Tremor and Other Hyperkinetic Movements**, v. 8, p. 595, 2018.
- BADENOCH, J.; CAVANNA, A. E. Pharmacotherapy for tics in adult patients with Tourette syndrome and other tic disorders. **Neurological Sciences**, v. 41, p. 1923-1926, 2020.
- BALDERMANN, J. C. et al. Thalamic deep brain stimulation for Tourette Syndrome: A naturalistic trial with brief randomized, double-blinded sham-controlled periods. **Brain Stimulation**, v. 14, n. 5, p. 1059-1067, 2021.
- BILLNITZER, A.; JANKOVIC, J. Current management of tics and Tourette syndrome: behavioral, pharmacologic, and surgical treatments. **Neurotherapeutics**, v. 17, p. 1681-1693, 2020.
- CAPPON, D. et al. Globus pallidal deep brain stimulation for Tourette syndrome: Effects on cognitive function. **Parkinsonism & Related Disorders**, v. 69, p. 14-18, 2019.
- CASAGRANDE, S. C. B. et al. Deep brain stimulation in Tourette's syndrome: evidence to date. **Neuropsychiatric disease and treatment**, p. 1061-1075, 2019.
- CHOU, C.Y. et al. Emerging therapies and recent advances for Tourette syndrome. **Heliyon**, p. e12874, 2023.
- DYKE, K. et al. Non-invasive brain stimulation as therapy: Systematic review and recommendations with a focus on the treatment of Tourette syndrome. **Experimental Brain Research**, v. 240, n. 2, p. 341-363, 2022.
- EAPEN, V. et al. Comprehensive behavioural intervention for tics: a neurophysiological intervention. **Journal of Integrative Neuroscience**, v. 21, n. 3, p. 89, 2022.
- FREY, J.; MALATY, I. A. Tourette syndrome treatment updates: a review and discussion of the current and upcoming literature. **Current Neurology and Neuroscience Reports**, v. 22, n. 2, p. 123-142, 2022.
- GROTH, C. Tourette syndrome in a longitudinal perspective. Clinical course of tics and comorbidities, coexisting psychopathologies, phenotypes and predictors. **Dan Med J**, v. 65, n. 4, p. 1-24, 2018.
- JANKOVIC, J. Treatment of tics associated with Tourette syndrome. **Journal of Neural Transmission**, v. 127, p. 843-850, 2020.
- KRACK, Paul et al. Deep brain stimulation in movement disorders: from experimental surgery to evidence-based therapy. **Movement disorders**, v. 34, n. 12, p. 1795-1810, 2019
- MAHAJAN, Uma V. et al. Deep brain stimulation results in greater symptomatic improvement in Tourette syndrome than conservative measures: a meta-analysis. **Stereotactic and Functional Neurosurgery**, v. 98, n. 4, p. 270-277, 2020.
- MARTINO, Davide; PRINGSHEIM, Tamara M. Tourette syndrome and other chronic tic disorders: an update on clinical management. **Expert review of neurotherapeutics**, v. 18, n. 2, p. 125-137, 2018.
- NOMURA, Y. Pharmacological therapy for Tourette syndrome: What medicine can do and cannot do. **biomedical journal**, v. 45, n. 2, p. 229-239, 2022.
- PANDEY, S.; DASH, D. Progress in pharmacological and surgical management of Tourette syndrome and other chronic tic disorders. **The Neurologist**, v. 24, n. 3, p. 93-108, 2019.

RIZWAN, M. et al. Efficacy of behavioural intervention, antipsychotics, and alpha agonists in the treatment of tics disorder in Tourette's syndrome. **Cureus**, v. 14, n. 2, 2022.

ROESSNER, V. et al. European clinical guidelines for Tourette syndrome and other tic disorders—version 2.0. Part III: pharmacological treatment. **European Child & Adolescent Psychiatry**, v. 31, p. 425-441, 2022.

SEIDEMAN, M. F.; SEIDEMAN, T. A. A review of the current treatment of Tourette syndrome. **The Journal of Pediatric Pharmacology and Therapeutics**, v. 25, n. 5, p. 401-412, 2020.

SUH, H-W. et al. Nonpharmacological treatments for Tourette syndrome and tic disorders: A protocol for systematic review and network meta-analysis. **Medicine**, v. 100, n. 19, 2021.

SZEJKO, Natalia et al. European clinical guidelines for Tourette syndrome and other tic disorders—version 2.0. Part IV: deep brain stimulation. **European Child & Adolescent Psychiatry**, v. 31, n. 3, p. 443-461, 2022.

XU, W. et al. Deep brain stimulation for Tourette's syndrome. **Translational neurodegeneration**, v. 9, p. 1-19, 2020.