Curr Treat Options Psych (2016) 3:253–265
DOI 10.1007/s40501-016-0091-8

Anxiety, Obsessive Compulsive, and Related Disorders (B Brennan and D Dougherty, Section Editors)

Approaches to the Diagnosis and Treatment of OCD with Comorbid Tic Disorders

Natasha T. Kostek, M.A
Blanca Garcia-Delgar, M.D
Ariz Rojas, Ph.D
Maxwell Luber, B.A
Barbara J. Coffey, M.D., M.S.[*]

Address
[*]Icahn School of Medicine at Mount Sinai, One Gustave Levy Place, Box 1230, New York, NY, 10029, USA
Email: barbara.coffey@mssm.edu

Published online: 11 July 2016

This article is part of the Topical Collection on *Anxiety, Obsessive Compulsive and Related Disorders*

Keywords Obsessive–compulsive disorder · Tic disorders · Diagnosis · Treatment

Opinion statement

Bidirectional overlap has long been described between obsessive–compulsive disorder (OCD) and tic disorders. Similar features, including underlying neurobiological genesis in frontal-striatal circuitry, familiality, relatively early onset, waxing and waning course, and overlapping phenomenology in repetitive behaviors, suggest different variations of the same disorder. Nevertheless, some differences have been described between OCD and tic disorders: tics begin early in childhood and typically attenuate or remit by late adolescence, whereas OCD tends to onset later and persist, and tic disorders are far more common in males than is the case in OCD. Individuals with OCD plus comorbid tics may represent a specific sub-type of OCD or tic disorders, and possess some important phenomenological differences from those with OCD without tics; for example, tic-related OCD tends to have earlier onset, higher prevalence in males, prominent symmetry, evening-up, counting, and "just-right" phenomenology, when compared with non-tic-related OCD. Recent *DSM-5* classification changes now recognize presence of tics as a specifier in diagnosis of OCD; despite a 40 % prevalence rate of comorbid tics in childhood-onset OCD, there is still little data regarding risk factors, validated distinguishing features, course and treatment of this diagnostic group. Prominence of premonitory sensory phenomena, urges or sensations experienced prior to the repetitive behaviors, is no longer thought to distinguish complex motor tics from compulsions. Well established treatments of OCD include cognitive behavioral interventions and pharmacotherapy, specifically the serotonin re-uptake

inhibitors (SRIs); although these treatments are also beneficial in tic-related OCD, some studies suggest that at least for pharmacotherapy, SRIs may not be as effective in OCD patients with comorbid tics. Given the frequent overlap of OCD and tics, and the recent designation of tic-related OCD as an OCD specifier, more investigation of the comorbid subtype is clearly needed.

Introduction

High rates of comorbidity between obsessive–compulsive disorder (OCD) and tic disorders, changes in the *DSM-5*, and novel findings about the phenomenology of each disorder have important diagnostic and treatment implications for patients.

Obsessive–compulsive disorder (OCD) is a heterogeneous and impairing condition with lifetime prevalence rates ranging from 0.7 to 3.0 % [1, 2]. OCD is characterized by the presence of obsessions and/or compulsions. Obsessions are intrusive and unwanted thoughts, urges or images that elicit significant distress [3]. Typical obsessional content spans four dimensions, including illness and contamination fears, unwanted aggressive thoughts, the need for symmetry or exactness, and forbidden sexual or religious thoughts. Compulsions, such as checking, counting, excessive cleaning, or reassurance seeking, are overt time-consuming, repetitive behaviors or covert mental acts conducted in response to obsessions which aim to reduce distress or preventing an anxiety-inducing situation. The overwhelming majority of OCD cases involve both obsessions and compulsions, but a diagnosis can be made if only one class of symptoms is present [3]. Diagnosis is made by clinical examination, which may include semi-structured interviews, in children, adolescents and adults. Symptom severity is evaluated with use of gold-standard clinician-administered assessments, such as the Yale–Brown Obsessive–Compulsive Scale (Y-BOCS) [4] for adults, and the Children's Yale–Brown Obsessive–Compulsive Scale (CY-BOCS) [5] for children and adolescents. Dimensional instruments may also aid in diagnosis and include the Obsessive–Compulsive Inventory Revised (OCI-R) [6], the Dimensional Obsessive–Compulsive Scale (DOCS) [7], and the Dimensional Yale–Brown Obsessive–Compulsive Scale (DY-BOCS) [8].

The international prevalence rate of OCD is estimated to be between 0.1 to 1.8 % [9]. Prevalence of OCD across ethnic groups appears to be consistent (e.g., 1.6 %) [10]. The mean age at diagnosis is 19.5 years [1], although many patients report that symptoms began in childhood. Studies suggest that OCD onset tends to occur earlier in males, before the age of 10 years, whereas a larger proportion of females are diagnosed with OCD throughout adolescence and early adulthood [1]. Furthermore, there is a subset of women who experience peri- and postpartum onset of OCD symptoms that require treatment [11].

In the fifth version of the Diagnostic and Statistical Manual of Mental Disorders (*DSM-5*), obsessions and/or compulsions remain core criteria for an OCD diagnosis, but some changes have been made, such that OCD is no longer classified as an anxiety disorder and is now part of a separate section entitled "Obsessive–Compulsive and Related Disorders". Additionally, a new specifier to describe *tic-related* OCD has been included. This subtype occurs in 10 to 40 % of childhood-onset OCD cases [12] and has important diagnostic, as well as treatment, implications for patients. Tic disorders are a category of neurodevelopmental disorders characterized by motor and/or vocal tics with onset before the age of 18 years. Tics are defined as sudden, rapid, involuntary, non-rhythmic movements or vocalizations. Similar to OCD, tics are heterogeneous in presentation and can be classified as simple or complex. Simple tics involve one muscle group or sound; complex tics are more purposeful and coordinated, involving multiple muscle groups or multiple sounds, words, or phrases [3].

Tics are sub-classified in the *DSM-5* as motor disorders among the neurodevelopmental disorders, which by definition, require that tic onset occur before the age of 18 years. Tic disorders are primarily distinguished by duration and whether or not they are motor or vocal. They include (a) Tourette's disorder (TD), also known as Gilles de la Tourette syndrome or Tourette syndrome, which is distinguished from other *DSM-5* tic disorders because a TD diagnosis requires multiple motor tics and at least one vocal tic; (b) provisional (formerly transient) tic disorder requires that motor tics, vocal tics, or both are present for less than one year since first tic onset; (c) persistent (chronic) motor or vocal tic disorder is diagnosed when motor or vocal tics are present for more than one year since first tic onset; and (d) other specified

or unspecified tic disorders encompass a diagnostic category in which tic symptoms are present, but criteria for a tic disorder are not met [3].

In Tourette's disorder, tic onset occurs between the ages of 4 to 6 years and reaches a peak between the ages of 10 to 12 years [13]. Generally, motor tics precede vocal tics, simple tics precede complex tics, and tics tend to progress from the head and face downward [14]. Validated scales used to assess tic severity and phenomena include the Yale Global Tic Severity Scale (YGTSS) [15], Premonitory Urge for Tics Scale (PUTS) [16], and Tic Symptom Self Report (TSSR) [17].

Provisional tic disorder is the most common tic disorder, occurring in 11 to 20 % of school-age children [18–22]. Estimates for prevalence of persistent motor tic disorder range between 3 to 50 cases per 1000 children, whereas persistent vocal tic disorder falls in the 2.9 to 9.4 per 1000 prevalence range [18]. Prevalence rates of TD also vary; the worldwide rate is most frequently estimated at approximately 1 % [23]. Scahill and colleagues (2014) suggest that the rate of 3 per 1000 children reported by the US Centers for Disease Control may have underestimated the prevalence of TD [18]. Their review of 11 international community surveys since 2000 reports TD prevalence ranging from 0.5 to 38 cases per 1000 children, with 6 per 1000 children as the "best" estimate [18]. Prevalence of tic disorders varies across gender and race. TD is 3 to 4 times more common in males. TD is a worldwide phenomenon, but its prevalence is reported to be lower in Hispanic or non-Hispanic black individuals (1.6 and 1.5 per 1000, respectively) [18].

OCD with comorbid tic disorders

OCD and tic disorders frequently co-occur. There is an established bidirectional overlap; for example, individuals with OCD have a 7 % lifetime risk of TD and a 20 to 30 % risk of tics [24–28] and individuals with a tic disorder have a 25 to 50 % risk of meeting full criteria for OCD, and up to 80 % have subthreshold obsessive–compulsive symptoms [29–34]. This bidirectional overlap between tics and OCD symptoms suggests a genetic relationship between OCD and tic disorders. Family studies indicate that OCD and tic disorders (specifically TD and persistent tic disorder) are genetically linked [35]. More recently, TD and OCD Genome-Wide Association Studies (GWAS) have identified overlapping signals at the molecular level [36]. Yu and colleagues identified a 0.41 correlation between the genes in both disorders [37•]. The researchers further identified distinct genetic loci in OCD with co-occurring tics versus OCD without tics. In addition to these genetic findings, neuroimaging studies also support the inclusion of a tic-related OCD subtype in the *DSM-5*. Disruptions of coordinated function within frontostriatal circuit structures are associated with repetitive behaviors both in OCD and tic disorders [38]. Specifically, tics in TD have been related to changes in the sensorimotor circuit through the putamen, whereas obsessions and compulsions in OCD have been associated with the limbic circuit [38].

Given the genetic, neurobiological, and phenomenological overlap between the two disorders, disentangling compulsions (e.g., repetitive touching or tapping) from complex motor tics can be a challenging task. Both tic disorders and OCD are characterized by a waxing and waning course of symptoms. One way to differentiate between the two disorders is to examine longitudinal course. Tic symptoms often attenuate or remit by young adulthood, whereas childhood-onset OCD symptoms generally persist [39, 40]. Only about 5 to 10 % of OCD cases are reported to spontaneously remit [39, 40]. In recognition of this overlap, diagnostic criteria for OCD in the *DSM-5* were changed to improve diagnostic clarity. For instance, in the *DSM-IV-TR* obsessions were classified as "ideas, images, or impulses," but in *DSM-5* the word "impulse" was supplanted by "urges" [3, 12]. Furthermore, the tic-related OCD specifier was introduced.

The clinical presentation of tic-related OCD differs from non-tic-related OCD. Tic-related OCD is reported more often in males and with earlier onset, when compared with non-tic-related OCD cases. Tic-related OCD commonly centers around symmetry, evening-up behaviors, obsessional counting, and "just-right" phenomena; in contrast, non-tic OCD or "pure OCD" is associated with higher rates of contamination fears and cleaning rituals [41, 42]. However, more recent studies suggest that tic-related OCD is not associated with a specific OCD symptom profile [43].

Despite the *DSM-5* diagnostic changes there is still insufficient information to disentangle the two conditions. Per the *DSM-5*, the primary differentiating feature between OCD and tic disorders is that compulsions are typically executed in response to an obsession, to achieve a "just-right" feeling, or to fulfill a proscribed set of rules. In contrast, a differentiating hallmark of tics is that they are typically preceded by premonitory sensory urges [3]. A growing body of literature suggests,

however, that sensory phenomena can precede compulsions as well [44, 45]. Originally, sensory phenomena were thought to occur primarily in individuals with OCD and comorbid TD or persistent tic disorder [46]. However, sensory phenomena have been identified in individuals with OCD without tics [44, 45, 47–49]. Although sensory phenomena may be more common in OCD patients who have comorbid tics (87 %), rates of sensory phenomena are also high for patients without tics (67 %) [49]. This presents diagnostic challenges for clinicians and researchers. The most common sensory phenomena across both groups are "just-right" sensations [49]. Recently, the University of São Paulo Sensory Phenomena Scale (USP-SPS), a semi-structured instrument, has been developed to assess the presence and severity of sensory phenomena that may occur before or during the execution of repetitive behaviors [50]. While this instrument may not assist in diagnosis, it may serve as a useful assessment of phenomenology. More research is needed in order to determine how the presence and type of sensory phenomena can aid in the differential diagnosis of OCD and tic disorders.

Treatment options

Cognitive-behavioral therapy

Cognitive-behavioral therapy (CBT) is considered a first line intervention for OCD in youth and adults [51–53]. CBT is an evidence-based and time-limited form of psychotherapy that equips patients and family members (most commonly children) with strategies to respond to disabling symptoms. CBT usually combines psychoeducation, cognitive therapy, and exposure and response prevention (ERP). Recent studies suggest that the latter is the most active component of a CBT intervention for OCD [54].

While there is a large body of literature demonstrating the efficacy and effectiveness of CBT for the treatment of OCD, there are fewer studies of its efficacy for OCD with comorbid tics. Most of the existing literature examines the influence of tics on treatment outcome as a post hoc or secondary analysis. A seminal study by Piacentini and colleagues (2002) examined the role of tics as a predictor of CBT response in a sample of children and adolescents with OCD [55]. Poorer response to CBT was predicted by severe obsessions and greater academic impairment at baseline, but not to a lifetime history of tics. Subsequent studies in pediatric samples have replicated these findings, suggesting that improvement of OCD symptoms with CBT is not impacted by tics [56, 57].

Other treatment studies have investigated the response to CBT in patients with tic-related versus non-tic-related OCD. Utilizing group CBT treatment in a small pilot study, Himle and colleagues (2003) found similar reductions in CY-BOCS scores for all participants regardless of the tic-related subtype [58]. These findings were recently replicated in a sample of youth with OCD, which included 29 participants with tic disorders and 29 without tic disorders [59]. Following treatment with individualized CBT for OCD, there were no differences in outcomes between the two groups. Moreover, the researchers noted that participants with OCD and comorbid tics required fewer CBT sessions than children without tics. The authors related this finding to differences in the OCD profile between the two groups and not to the presence of tics. Despite a lack of statistical significance, cleaning compulsions were more common in the OCD group without tics, and the authors stated that these compulsions might be less responsive to CBT than other obsessive–compulsive symptoms.

Taken together, it is well established that CBT with ERP is an effective treatment for OCD in children, adolescents, and adults. While the presentations

vary greatly among individuals, less is known regarding the efficacy of CBT for individuals who have OCD and tics. Even less is known about the response of individuals with tic-related OCD to CBT. The extant literature suggests that CBT for tic-related OCD is still effective and its efficacy may be higher than for OCD without tics [60••]. However, there is a dearth of information regarding the need for adaptations to traditional ERP protocols. Studies in this area are limited to pediatric samples; more information is needed on treatment with adults.

CBT/ERP adaptations

The most skillful clinicians cannot deliver effective CBT if they are limited by information. Some of the pitfalls of effective therapy lie in the fact that treatment is not tailored to the individual. As with all CBT protocols, clinicians must ensure that patients and parents alike can provide detailed monitoring of OCD and tic symptoms. Clinicians may benefit from providing patients with self-report measures to determine level of premonitory urges (e.g., PUTS measure) [16]. Equipped with this information, the clinician can develop a tailored hierarchy of exposures. Exposures are exercises that are designed to create anxiety or discomfort in a patient. The basis of exposure therapy is to teach patients to tolerate uncertainty and discomfort. For patients with OCD and tics, a decision can be made as to when to address tics versus OCD. For patients who maintain traditional OCD subtypes (e.g., contamination, harm, and sexual obsessions), a formal exposure hierarchy is developed and response prevention guidelines are provided for compulsions. To address impairing tics, habit reversal techniques (HRT) are employed, a component of Comprehensive Behavioral Intervention for Tics (CBIT) [61].

For tic-related OCD, CBT components are not created equal. The use of cognitive interventions is limited. For patients, the urge/discomfort is visceral, not distorted. As a result, patients cannot utilize cognitive reframing techniques. Although patients benefit greatly from psychoeducation, they may not be able to utilize logic for addressing a just-right feeling. Instead, clinicians can teach patients that the discomfort that is being experienced is "temporary" in duration. This positive "self-talk" often sets the stage for behavioral therapy.

Prior to starting CBT/ERP, it is important to determine when it is most appropriate to utilize exposure versus response prevention/habit reversal for tic-related OCD. This decision is dependent on the type of OCD (e.g., just-right compulsion, evening-out, touching, tapping). In the case of exposure, a hierarchy can include triggering events that are likely to promote a feeling of discomfort or "not-right" feeling. Both adult and child patients often find it difficult to discriminate triggering events, as well as the magnitude to which exposures will cause distress. They may find it challenging to rank the order of exposures because the phenomenon is not of fear but one of disgust/anguish. For example, it is often difficult to create stepwise hierarchies for tic-related OCD. Instead, exercises may include guidelines such as response prevention for "weak" urges and work up to response prevention for "strong" urges. Planned exposures may pose difficulty, given that tic-related OCD is not based on intrusive thoughts but often external-triggers or internal-urge triggers. It is often useful to take "field trips" to promote generalizability and to come into contact with naturalistic triggers. These in vivo exposures allow the clinician to coach the

patient "in-the-moment." Such exposures can include walking and not evening-out steps, moving items around in an office so as to not be symmetrical, tapping the "wrong way" or eating on the "wrong" side of the mouth, touching one side of the body but and not the other, and writing the "wrong" way. In each of these scenarios, the exposures are conducted, over time, until the individual is no longer distressed. Patients who have tic-related OCD may need shorter duration or fewer sessions. This is likely due to the fact that a distorted thought is not maintaining the disorder.

Another clinical anecdote is related to the amount of distress experienced by the individual. Patients with tic-related OCD are often quickly triggered to a very intense degree, but the duration of intense anxiety is much shorter than that of a patient without tic-related OCD. For example, a child who is participating in an evening-out exposure of brushing her right arm on the wall, but not the left arm may immediately experience a 7/10 anxiety rating, but only experience the 7 for 1 min, and quickly drop to 0 within 5 min. In contrast, that same child with a contamination exposure may report a 3/10 anxiety rating after eating a piece of bread off the table, raise to a peak of 7/10 after 5 min because the fear of getting sick and vomiting is triggered, and drop to a 3/10 after 15 min. In this instance, the distorted thought of getting sick because of germs maintains the anxiety, because it cannot be proven immediately where the feeling of discomfort from an "uneven body" eventually fades.

Overall, it has been our experience that CBT with ERP is effective in treating patients with OCD and comorbid tics. The most effective approach lies in the ability of the clinician to know the patient's triggers and response to discomfort, as well as flexibility and creativity in the delivery of ERP. When necessary, it is important to introduce HRT skills in order to build the patient's resources for managing symptoms.

Selective serotonin re-uptake inhibitors

Treatment with selective serotonin re-uptake inhibitors (SSRIs) is considered the first line pharmacologic intervention for OCD in youth and adults. Practice parameters suggest that mild to moderate OCD should be treated first with CBT, whereas moderate to severe OCD generally requires a combination of CBT and medication [51–53]. Individuals with severe or extreme OCD may need to start medication before they can fully engage in CBT.

Evidence suggests that SSRI treatment may be less effective in individuals with OCD with tics than in OCD without tics. One example comes from a retrospective case control study of fluvoxamine in adults with OCD [62]. In this study, those with OCD and chronic tic disorder were age and sex-matched with patients without tics. After 8 weeks of treatment with fluvoxamine, OCD symptom reduction was observed in both groups, but the magnitude of response was lower in the OCD + tics group. Similar results have been reported in more recent studies in adult [63] and pediatric samples [64, 65]. Although some studies have suggested that comorbid tics may lower the magnitude of response to SSRIs in treatment of OCD, tics did not moderate treatment efficacy/response, or symptom remission in a pediatric OCD meta-analysis (although a trend toward lower effect sizes was reported for symptom remission, defined as CY-BOCS scores ≤ 14 or Clinical Global Scales-Severity rating of "no illness" or "mild illness") [60••].

In light of these findings, subjects with moderate to severe OCD and comorbid tics are still candidates for treatment with an SSRI, although the magnitude of response may be lower than that in OCD without tics. As would be the case in treatment of OCD without tics, it is generally recommended that pharmacotherapy be initiated with one SSRI and maintained for about 6–8 weeks in adults and 8–10 weeks in youth; if the first agent is not beneficial or intolerable, a second SSRI trial is recommended. If the second agent is not effective or intolerable, many clinicians would go next to clomipramine, particularly if OCD symptoms are still in the severe range.

How should CBT and SSRIs be initiated?

Evidence-based practice strongly encourages clinicians to follow established practice parameter guidelines for treatment of OCD and tic disorders [51–53]. However, there is little specific information to guide treatment of OCD plus tics. Results of the Pediatric OCD Treatment Study (POTS), the first randomized, controlled trial of pediatric OCD comparing CBT, sertraline, and combination treatment to placebo, indicated that comorbid tics attenuated response to sertraline, but not to CBT or the combination therapy conditions [64]. As a result, the authors concluded that children and adolescents with tic-related OCD should begin treatment with CBT alone or in combination with a SSRI. If children and adolescents with OCD and tics do not show an adequate response to CBT alone, authors of the Nordic Long-Term OCD Treatment Study (NordLOTS) suggest that discontinuation of CBT and initiation of an SSRI may be more effective than maintenance of CBT [57, 66]. In the sections to follow, we suggest pharmacological options for treatment-resistant OCD with comorbid tics.

Alternate psychopharmacological treatment options

Antipsychotic augmentation

The addition of an antipsychotic medication to an SSRI to augment treatment response is a highly studied intervention for treatment-refractory OCD. In adults, findings from a recent meta-analysis support the addition of risperidone or aripiprazole in patients with OCD who do not show an adequate response to SSRIs or clomipramine [67]. The efficacy of antipsychotic augmentation has also been reported for individuals with tic-related OCD. Studies with atypical antipsychotics (e.g., risperidone and quetiapine) found augmentation to be equally effective in adults with OCD with and without tics [68, 69], whereas one study with haloperidol reported more favorable outcomes in fluvoxamine-refractory patients with comorbid tic disorders compared to those without tics [70].

In children, beneficial effects for augmentation of SSRIs with either risperidone or aripiprazole have been reported [71–73]. The aripiprazole study found no differences in treatment efficacy when adolescents with and without tics were compared [73]. The first head-to-head comparative study to investigate two antipsychotics in SSRI augmentation in children and adolescents with treatment-refractory OCD and comorbid tics found that both risperidone and aripiprazole were effective in reduction of OCD symptoms in about half of the sample [74•]. Antipsychotics were

randomly assigned and added after patients showed a partial response to 12-week SSRI monotherapy. More than half of the sample reported improvement in tic symptoms. There were no statistically significant differences in treatment outcome between the risperidone and aripiprazole conditions. With regard to adverse events, risperidone was associated with weight gain and sedation, and aripiprazole with mild/moderate agitation.

In sum, antipsychotic augmentation may be an effective strategy for treatment-refractory OCD with tic disorders in adults and children/adolescents. There is additional evidence that this combination can be useful for the treatment of tics.

Clomipramine

Clomipramine is an alternative psychopharmacological intervention to consider when response to SSRIs is inadequate [53, 75]. Studies of the efficacy of clomipramine for treatment of OCD and comorbid tics are scarce and inconsistent. On the one hand, a study with adult patients found that comorbid tics were not associated with poorer response to a 14-week trial of clomipramine [76], whereas another study in children and adolescents with a lifetime history of tics reported an attenuated response to treatment [77].

Clomipramine has also been suggested as an augmentation strategy for SSRIs [75]. The approach is to increase plasma levels of clomipramine and minimize adverse effects through inhibition of its metabolism (SSRIs inhibit the cytochrome oxidase enzyme that metabolize clomipramine) and not through dosage increase. The efficacy of this combination has not been examined specifically in patients with OCD and tics.

Alternative pharmacological strategies to explore

Other strategies which have been reported for treatment-refractory OCD, such as increasing the dose of the SSRI or novel augmentation strategies (e.g., memantine, riluzole, amantadine, or ondasetron), have not been studied in tic-related OCD. This area warrants further research.

Neuromodulation techniques

Transcranial magnetic stimulation (TMS)

TMS is a non-invasive brain stimulation technique that has been used for treatment of a variety of brain disorders, including OCD [78, 79]. Evidence for its use in patients with OCD and comorbid tics is still limited but promising. Recently, a study of 12 patients with refractory TD treated with deep TMS reported that tics did not improve among the group as a whole, but the subgroup of patients with comorbid OCD showed significant improvement in tic severity and OCD symptoms [80•].

Deep brain stimulation (DBS)

DBS is a neurosurgical procedure used in movement and psychiatric disorders with use of an implanted neurostimulator in specific parts of the brain. DBS

may show promise for treatment-refractory OCD, but its effect on comorbid tic disorders has not yet been investigated [81].

Electroconvulsive therapy (ECT) and transcranial direct current stimulation

Other neuromodulation techniques such as electroconvulsive therapy (ECT) and transcranial direct current stimulation (tDCS) have not shown positive results in the treatment of OCD [82].

Conclusions

Treatment algorithm

Taking into account the extant evidence base and our current practice, the following treatment algorithm is suggested for treatment of OCD and tic disorders with mild to moderate symptoms (Fig. 1).

Future steps

A better understanding of the genetic, phenomenological, and neurobiological differences between tic-related and non-tic-related OCD will lead to further treatment advances. Given that sensory phenomena have been implicated in OCD, it may be prudent to revise or develop assessments to routinely screen for the presence of sensory phenomena in both OCD and tic disorders. Given that CBT is the first line treatment for both OCD and TD, we suggest the development of manualized treatment integrating ERP and HRT to target both obsessive–compulsive symptoms and tics. From a psychopharmacological perspective, we suggest that controlled trials in youth and adults with OCD plus tics specifically focus on dosage, time to response, and optimal augmentation

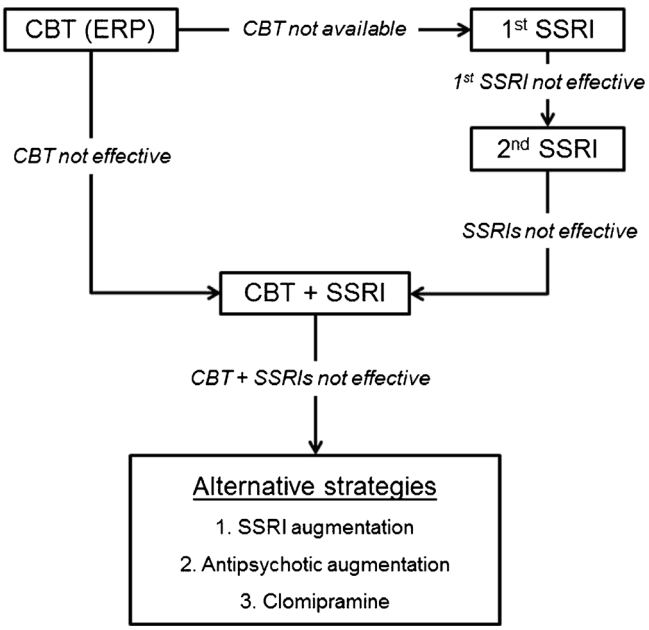

Fig. 1. A schematic diagram of the authors' proposed treatment algorithm.

strategies. Investigation of medications for patients with treatment-refractory OCD and tics which have fewer adverse effects than antipsychotics or clomipramine are necessary. Overall, more research is needed so as to develop more specific and effective treatments for OCD and tic disorders.

Acknowledgments

This material is the result of work supported with resources and the use of facilities at the Icahn School of Medicine at Mount Sinai.

Compliance with Ethical Standards

Conflict of Interest

Natasha T. Kostek and Maxwell Luber declare that they have no conflict of interest.
Blanca Garcia-Delgar reports research grants from the Alicia Koplowitz Foundation, outside the submitted work.
Ariz Rojas reports personal fees from Bracket, grants from Auspex, outside the submitted work.
Barbara J. Coffey reports other from American Academy of Child and Adolescent Psychiatry, other from AstraZeneca, non-financial support and other from Auspex/Teva, other from Catalyst, other from Neurocrine/Bracket, grants from NIMH, non-financial support from Genco Sciences, other from Shire, grants and other from Tourette Association of America, outside the submitted work.

Human and Animal Rights and Informed Consent

Barbara J. Coffey is an author of two studies that involved human subjects.

References and Recommended Reading

Papers of particular interest, published recently, have been highlighted as:
• Of importance
•• Of major importance

1. Ruscio AM, Stein DJ, Chiu WT, Kessler RC. The epidemiology of obsessive-compulsive disorder in the National Comorbidity Survey Replication. Mol Psychiatry. 2010;15:53–63.
2. Fontenelle LF, Mendlowicz MV, Versiani M. The descriptive epidemiology of obsessive-compulsive disorder. Prog Neuro-Psychopharmacol Biol Psychiatry. 2006;30:327–37.
3. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Arlington: American Psychiatric Association; 2013.
4. Goodman WK, Price LH, Rasmussen SA, Mazure C, Fleischmann RL, Hill CL, et al. The Yale-Brown Obsessive Compulsive Scale. I. Development, use, and reliability. Arch Gen Psychiatry. 1989;46:1006–11.
5. Scahill L, Riddle MA, McSwiggin-Hardin M, Ort SI, King RA, Goodman WK, et al. Children's Yale-Brown Obsessive Compulsive Scale: reliability and validity. J Am Acad Child Adolesc Psychiatry. 1997;36:844–52.
6. Foa EB, Huppert JD, Leiberg S, Langner R, Kichic R, Hajcak G, et al. The obsessive-compulsive inventory: development and validation of a short version. Psychol Assess. 2002;14:485–96.
7. Abramowitz JS, Deacon BJ, Olatunji BO, Wheaton MG, Berman NC, Losardo D, et al. Assessment of obsessive-compulsive symptom dimensions: development and evaluation of the dimensional obsessive-compulsive scale. Psychol Assess. 2010;22:180–98.
8. Rosario-Campos MC, Miguel EC, Quatrano S, Chacon P, Ferrao Y, Findley D, et al. The Dimensional Yale-Brown Obsessive-Compulsive Scale (DY-BOCS): an

instrument for assessing obsessive-compulsive symptom dimensions. Mol Psychiatry. 2006;11:495–504.
9. Weissman MM, Bland RC, Canino GJ, Greenwald S, Hwu HG, Lee CK, et al. The cross national epidemiology of obsessive compulsive disorder. The Cross National Collaborative Group. J Clin psychiatry. 1994;55(Suppl):5–10.
10. Himle JA, Muroff JR, Taylor RJ, Baser RE, Abelson JM, Hanna GL, et al. Obsessive-compulsive disorder among African Americans and blacks of Caribbean descent: results from the National Survey of American Life. Depress Anxiety. 2008;25:993–1005.
11. Neziroglu F, Anemone R, Yaryura-Tobias JA. Onset of obsessive-compulsive disorder in pregnancy. Am J Psychiatry. 1992;149:947–50.
12. Leckman JF, Denys D, Simpson HB, Mataix-Cols D, Hollander E, Saxena S, et al. Obsessive-compulsive disorder: a review of the diagnostic criteria and possible subtypes and dimensional specifiers for DSM-V. Depress Anxiety. 2010;27:507–27.
13. Bloch MH, Leckman JF. Clinical course of Tourette syndrome. J Psychosom Res. 2009;67:497–501.
14. Robertson MM. The Gilles de la Tourette syndrome: the current status. Arch Dis Child Educ Pract Ed. 2012;97:166–75.
15. Leckman JF, Riddle MA, Hardin MT, Ort SI, Swartz KL, Stevenson J, et al. The Yale Global Tic Severity Scale: initial testing of a clinician-rated scale of tic severity. J Am Acad Child Adolesc Psychiatry. 1989;28:566–73.
16. Woods DW, Piacentini J, Himle MB, Chang S. Premonitory Urge for Tics Scale (PUTS): initial psychometric results and examination of the premonitory urge phenomenon in youths with Tic disorders. J Dev Behav Pediatr. 2005;26:397–403.
17. Scahill L, Leckman JF, Schultz RT, Katsovich L, Peterson BS. A placebo-controlled trial of risperidone in Tourette syndrome. Neurology. 2003;60:1130–5.
18. Scahill L, Specht M, Page C. The prevalence of tic disorders and clinical characteristics in children. J Obsessive Compulsive Relat Disord. 2014;3:394–400.
19. Cubo E, y Gabriel Galan JM, Villaverde VA, Velasco SS, Benito VD, Macarron JV, et al. Prevalence of tics in schoolchildren in central Spain: a population-based study. Pediatr Neurol. 2011;45:100–8.
20. Kurlan R, McDermott MP, Deeley C, Como PG, Brower C, Eapen S, et al. Prevalence of tics in schoolchildren and association with placement in special education. Neurology. 2001;57:1383–8.
21. Linazasoro G, Van Blercom N, de Zarate CO. Prevalence of tic disorder in two schools in the Basque country: results and methodological caveats. Mov Disord. 2006;21:2106–9.
22. Snider LA, Seligman LD, Ketchen BR, Levitt SJ, Bates LR, Garvey MA, et al. Tics and problem behaviors in schoolchildren: prevalence, characterization, and associations. Pediatrics. 2002;110:331–6.
23. Robertson MM, Eapen V, Cavanna AE. The international prevalence, epidemiology, and clinical phenomenology of Tourette syndrome: a cross-cultural perspective. J Psychosom Res. 2009;67:475–83.
24. do Rosario-Campos MC, Leckman JF, Curi M, Quatrano S, Katsovitch L, Miguel EC, et al. A family study of early-onset obsessive-compulsive disorder. Am J Med Genet B Neuropsychiatr Genet. 2005;136B:92–7.
25. Ivarsson T, Melin K, Wallin L. Categorical and dimensional aspects of co-morbidity in obsessive-compulsive disorder (OCD). Eur Child Adolesc Psychiatry. 2008;17:20–31.
26. Nestadt G, Di CZ, Riddle MA, Grados MA, Greenberg BD, Fyer AJ, et al. Obsessive-compulsive disorder: subclassification based on co-morbidity. Psychol Med. 2009;39:1491–501.
27. Torresan RC, Ramos-Cerqueira AT, Shavitt RG, do Rosario MC, de Mathis MA, Miguel EC, et al. Symptom dimensions, clinical course and comorbidity in men and women with obsessive-compulsive disorder. Psychiatry Res. 2013;209:186–95.
28. Nikolajsen KH, Nissen JB, Thomsen PH. Obsessive-compulsive disorder in children and adolescents: symptom dimensions in a naturalistic setting. Nordic J Psychiatry. 2011;65:244–50.
29. Frankel M, Cummings JL, Robertson MM, Trimble MR, Hill MA, Benson DF. Obsessions and compulsions in Gilles de la Tourette's syndrome. Neurology. 1986;36:378–82.
30. Freeman RD, Fast DK, Burd L, Kerbeshian J, Robertson MM, Sandor P. An international perspective on Tourette syndrome: selected findings from 3,500 individuals in 22 countries. Dev Med Child Neurol. 2000;42:436–47.
31. Gaze C, Kepley HO, Walkup JT. Co-occurring psychiatric disorders in children and adolescents with Tourette syndrome. J Child Neurol. 2006;21:657–64.
32. Mol Debes NM, Hjalgrim H, Skov L. Validation of the presence of comorbidities in a Danish clinical cohort of children with Tourette syndrome. J Child Neurol. 2008;23:1017–27.
33. Lebowitz ER, Motlagh MG, Katsovich L, King RA, Lombroso PJ, Grantz H, et al. Tourette syndrome in youth with and without obsessive compulsive disorder and attention deficit hyperactivity disorder. Eur Child Adolesc Psychiatry. 2012;21:451–7.
34. Cohen SC, Leckman JF, Bloch MH. Clinical assessment of Tourette syndrome and tic disorders. Neurosci Biobehav Rev. 2013;37:997–1007.
35. Grados MA, Riddle MA, Samuels JF, Liang KY, Hoehn-Saric R, Bienvenu OJ, et al. The familial phenotype of obsessive-compulsive disorder in relation to tic disorders: the Hopkins OCD family study. Biol Psychiatry. 2001;50:559–65.
36. Davis LK, Yu D, Keenan CL, Gamazon ER, Konkashbaev AI, Derks EM, et al. Partitioning the heritability of Tourette syndrome and obsessive compulsive disorder reveals differences in genetic architecture. PLoS Genet. 2013;9:e1003864.

37.• Yu D, Mathews CA, Scharf JM, Neale BM, Davis LK, Gamazon ER, et al. Cross-disorder genome-wide analyses suggest a complex genetic relationship between Tourette's syndrome and OCD. Am J Psychiatry. 2015;172:82–93.
This article highlights both the shared genetic variation in TD and OCD, as well as the differences in genetic susceptibility variants between OCD with co-occurring TD or chronic tics versus OCD alone.
38. Langen M, Durston S, Kas MJ, van Engeland H, Staal WG. The neurobiology of repetitive behavior: …and men. Neurosci Biobehav Rev. 2011;35:356–65.
39. Eisen JL, Pinto A, Mancebo MC, Dyck IR, Orlando ME, Rasmussen SA. A 2-year prospective follow-up study of the course of obsessive-compulsive disorder. J Clin Psychiatry. 2010;71:1033–9.
40. Eisen JL, Sibrava NJ, Boisseau CL, Mancebo MC, Stout RL, Pinto A, et al. Five-year course of obsessive-compulsive disorder: predictors of remission and relapse. J Clin Psychiatry. 2013;74:233–9.
41. Worbe Y, Mallet L, Golmard JL, Behar C, Durif F, Jalenques I, et al. Repetitive behaviours in patients with Gilles de la Tourette syndrome: tics, compulsions, or both? PLoS One. 2010;5:e12959.
42. Mansueto CS, Keuler DJ. Tic or compulsion?: it's Tourettic OCD. Behav Modif. 2005;29:784–99.
43. Conelea CA, Walther MR, Freeman JB, Garcia AM, Sapyta J, Khanna M, et al. Tic-related obsessive-compulsive disorder (OCD): phenomenology and treatment outcome in the Pediatric OCD Treatment Study II. J Am Acad Child Adolesc Psychiatry. 2014;53:1308–16.
44. Ferrao YA, Shavitt RG, Prado H, Fontenelle LF, Malavazzi DM, de Mathis MA, et al. Sensory phenomena associated with repetitive behaviors in obsessive-compulsive disorder: an exploratory study of 1001 patients. Psychiatry Res. 2012;197:253–8.
45. Miguel EC, Baer L, Coffey BJ, Rauch SL, Savage CR, O'Sullivan RL, et al. Phenomenological differences appearing with repetitive behaviours in obsessive-compulsive disorder and Gilles de la Tourette's syndrome. Br J Psychiatry J Ment Sci. 1997;170:140–5.
46. Diniz JB, Rosario-Campos MC, Hounie AG, Curi M, Shavitt RG, Lopes AC, et al. Chronic tics and Tourette syndrome in patients with obsessive-compulsive disorder. J Psychiatr Res. 2006;40:487–93.
47. de Alvarenga PG, de Mathis MA, Dominguez Alves AC, do Rosario MC, Fossaluza V, Hounie AG, et al. Clinical features of tic-related obsessive-compulsive disorder: results from a large multicenter study. CNS Spectr. 2012;17:87–93.
48. Miguel EC, do Rosario-Campos MC, Prado HS, do Valle R, Rauch SL, Coffey BJ, et al. Sensory phenomena in obsessive-compulsive disorder and Tourette's disorder. J Clin Psychiatry. 2000;61:150–6. quiz 7.
49. Shavitt RG, de Mathis MA, Oki F, Ferrao YA, Fontenelle LF, Torres AR, et al. Phenomenology of OCD: lessons from a large multicenter study and implications for ICD-11. J Psychiatr Res. 2014;57:141–8.
50. Rosario MC, Prado HS, Borcato S, Diniz JB, Shavitt RG, Hounie AG, et al. Validation of the University of Sao Paulo Sensory Phenomena Scale: initial psychometric properties. CNS Spectr. 2009;14:315–23.
51. Geller DA, March J, The AACAP Committee on Quality Issues (CQI). Practice parameter for the assessment and treatment of children and adolescents with obsessive-compulsive disorder. J Am Acad Child Adolesc Psychiatry. 2012;51:98–113.
52. Koran LM, Simpson HB. Guideline watch (March 2013): practice guideline for the treatment of patients with obsessive-compulsive disorder. Arlington: American Psychiatric Association; 2013.
53. National Institute for Health and Clinical Excellence. Obsessive-compulsive disorder and body dysmorphic disorder: Treatment. 2014. Available at: https://www.nice.org.uk/guidance/cg31. Accessed 4 May 2016.
54. McKay D, Sookman D, Neziroglu F, Wilhelm S, Stein DJ, Kyrios M, et al. Efficacy of cognitive-behavioral therapy for obsessive-compulsive disorder. Psychiatry Res. 2015;225:236–46.
55. Piacentini J, Bergman RL, Jacobs C, McCracken JT, Kretchman J. Open trial of cognitive behavior therapy for childhood obsessive-compulsive disorder. J Anxiety Disord. 2002;16:207–19.
56. Storch EA, Merlo LJ, Larson MJ, Geffken GR, Lehmkuhl HD, Jacob ML, et al. Impact of comorbidity on cognitive-behavioral therapy response in pediatric obsessive-compulsive disorder. J Am Acad Child Adolesc Psychiatry. 2008;47:583–92.
57. Torp NC, Dahl K, Skarphedinsson G, Compton S, Thomsen PH, Weidle B, et al. Predictors associated with improved cognitive-behavioral therapy outcome in pediatric obsessive-compulsive disorder. J Am Acad Child Adolesc Psychiatry. 2015;54:200–7. e1.
58. Himle JA, Fischer DJ, Van Etten ML, Janeck AS, Hanna GL. Group behavioral therapy for adolescents with tic-related and non-tic-related obsessive-compulsive disorder. Depress Anxiety. 2003;17:73–7.
59. Bennett S, Stark D, Shafran R, Heyman I, Krebs G. Evaluation of cognitive behaviour therapy for paediatric obsessive-compulsive disorder in the context of tic disorders. J Behav Ther Exp Psychiatry. 2015;49:223–9.
60.•• McGuire JF, Piacentini J, Lewin AB, Brennan EA, Murphy TK, Storch EA. A meta-analysis of cognitive behavior therapy and medication for child obsessive-compulsive disorder: moderators of treatment efficacy, response, and remission. Depress Anxiety. 2015;32:580–93.
This is a meta-analysis that examines moderators of treatment outcome—including the presence of a comorbid tic disorder—with cognitive behavior therapy or serotonin reuptake inhibitors in youth with obsessive-compulsive disorder.
61. Woods DW, Piacentini JC, Chang SW, Deckersbach T, Ginsburg GS, Peterson AL, et al. Managing tourette syndrome. A behavioral intervention for children and adults. New York: Oxford University Press; 2008.
62. McDougle CJ, Goodman WK, Leckman JF, Barr LC, Heninger GR, Price LH. The efficacy of fluvoxamine in

obsessive-compulsive disorder: effects of comorbid chronic tic disorder. J Clin Psychopharmacol. 1993;13:354–8.

63. Husted DS, Shapira NA, Murphy TK, Mann GD, Ward HE, Goodman WK. Effect of comorbid tics on a clinically meaningful response to 8-week open-label trial of fluoxetine in obsessive compulsive disorder. J Psychiatr Res. 2007;41:332–7.
64. March JS, Franklin ME, Leonard H, Garcia A, Moore P, Freeman J, et al. Tics moderate treatment outcome with sertraline but not cognitive-behavior therapy in pediatric obsessive-compulsive disorder. Biol Psychiatry. 2007;61:344–7.
65. Geller DA, Biederman J, Stewart SE, Mullin B, Farrell C, Wagner KD, et al. Impact of comorbidity on treatment response to paroxetine in pediatric obsessive-compulsive disorder: is the use of exclusion criteria empirically supported in randomized clinical trials? J Child Adolesc Psychopharmacol. 2003;13 Suppl 1:S19–29.
66. Skarphedinsson G, Compton S, Thomsen PH, Weidle B, Dahl K, Nissen JB, et al. Tics moderate sertraline, but not cognitive-behavior therapy response in pediatric obsessive-compulsive disorder patients who do not respond to cognitive-behavior therapy. J Child Adolesc Psychopharmacol. 2015;25:432–9.
67. Veale D, Miles S, Smallcombe N, Ghezai H, Goldacre B, Hodsoll J. Atypical antipsychotic augmentation in SSRI treatment refractory obsessive-compulsive disorder: a systematic review and meta-analysis. BMC Psychiatry. 2014;14:317.
68. McDougle CJ, Epperson CN, Pelton GH, Wasylink S, Price LH. A double-blind, placebo-controlled study of risperidone addition in serotonin reuptake inhibitor-refractory obsessive-compulsive disorder. Arch Gen Psychiatry. 2000;57:794–801.
69. Carey PD, Vythilingum B, Seedat S, Muller JE, van Ameringen M, Stein DJ. Quetiapine augmentation of SRIs in treatment refractory obsessive-compulsive disorder: a double-blind, randomised, placebo-controlled study [ISRCTN83050762]. BMC Psychiatry. 2005;5:5.
70. McDougle CJ, Goodman WK, Leckman JF, Lee NC, Heninger GR, Price LH. Haloperidol addition in fluvoxamine-refractory obsessive-compulsive disorder. A double-blind, placebo-controlled study in patients with and without tics. Arch Gen Psychiatry. 1994;51:302–8.
71. Fitzgerald KD, Stewart CM, Tawile V, Rosenberg DR. Risperidone augmentation of serotonin reuptake inhibitor treatment of pediatric obsessive compulsive disorder. J Child Adolesc Psychopharmacol. 1999;9:115–23.
72. Thomsen PH. Risperidone augmentation in the treatment of severe adolescent OCD in SSRI-refractory cases: a case-series. Ann Clin Psychiatry. 2004;16:201–7.
73. Masi G, Pfanner C, Millepiedi S, Berloffa S. Aripiprazole augmentation in 39 adolescents with medication-resistant obsessive-compulsive disorder. J Clin Psychopharmacol. 2010;30:688–93.
74.• Masi G, Pfanner C, Brovedani P. Antipsychotic augmentation of selective serotonin reuptake inhibitors in resistant tic-related obsessive-compulsive disorder in children and adolescents: a naturalistic comparative study. J Psychiatr Res. 2013;47:1007–12.

This is the first study that examines the efficacy of augmentation of selective serotonin reuptake inhibitors (SSRIs) with risperidone or aripiprazole in youth with tic-related obsessive-compulsive disorder that do not respond to an SSRI monotherapy.

75. American Psychiatric Association. Practice guideline for the treatment of patients with obsessive-compulsive disorder. Arlington: American Psychiatric Association; 2007.
76. Shavitt RG, Belotto C, Curi M, Hounie AG, Rosario-Campos MC, Diniz JB, et al. Clinical features associated with treatment response in obsessive-compulsive disorder. Compr Psychiatry. 2006;47:276–81.
77. Leonard HL, Swedo SE, Lenane MC, Rettew DC, Hamburger SD, Bartko JJ, et al. A 2- to 7-year follow-up study of 54 obsessive-compulsive children and adolescents. Arch Gen Psychiatry. 1993;50:429–39.
78. Bersani FS, Minichino A, Enticott PG, Mazzarini L, Khan N, Antonacci G, et al. Deep transcranial magnetic stimulation as a treatment for psychiatric disorders: a comprehensive review. Eur Psychiatry. 2013;28:30–9.
79. Berlim MT, Neufeld NH, Van den Eynde F. Repetitive transcranial magnetic stimulation (rTMS) for obsessive-compulsive disorder (OCD): an exploratory meta-analysis of randomized and sham-controlled trials. J Psychiatr Res. 2013;47:999–1006.
80.• Bloch Y, Arad S, Levkovitz Y. Deep TMS add-on treatment for intractable Tourette syndrome: a feasibility study. World J Biol Psychiatry. 2014. doi:10.3109/15622975.2014.964767.

This article reports promising therapeutic results with novel treatment procedures in treatment-resistant patients with TD and OCD.

81. Kisely S, Hall K, Siskind D, Frater J, Olson S, Crompton D. Deep brain stimulation for obsessive-compulsive disorder: a systematic review and meta-analysis. Psychol Med. 2014;44:3533–42.
82. Bais M, Figee M, Denys D. Neuromodulation in obsessive-compulsive disorder. Psychiatr Clin N Am. 2014;37:393–413.