

# The long-term outcomes of ocular tics in a pediatric neuro-ophthalmology practice

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<b>PURPOSE</b>	To describe the outcome and comorbidities of ocular tics in children evaluated by a pediatric neuro-ophthalmologist.
<b>METHODS</b>	The medical records of all consecutive patients in a pediatric neuro-ophthalmology practice diagnosed with ocular tics (eye rolling, blinking, and widening) were retrospectively reviewed. Children with known secondary causes for tics were excluded. Patients, parents, and/or guardians were contacted by telephone to obtain follow-up information.
<b>RESULTS</b>	A total of 43 patients were included in the retrospective cohort, with a mean age of $7.8 \pm 4.8$ years at diagnosis. Thirty-two patients participated in the follow-up survey, with an average follow-up of $6.1 \pm 3.9$ years. None of the 43 children carried a diagnosis of Tourette syndrome or obsessive-compulsive disorder (OCD) at presentation; 1 child had attention deficit hyperactivity disorder (ADHD). At follow-up, 14 of the 32 children (44%) had persistent ocular tics, 3 (9%) reported new nonocular motor tics, 5 (16%) reported new vocal tics, and 4 (13%) developed both nonocular motor and vocal tics. One patient (3%) was formally diagnosed with Tourette syndrome during the follow-up interval, and 3 (9%) were diagnosed with ADHD.
<b>CONCLUSIONS</b>	Almost half of the children with ocular tics at presentation had persistent ocular tics on follow-up. New nonocular motor and vocal tics occurred in several patients. (J AAPOS 2014;18:31-35)

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Tics are involuntary, rapid, repetitive, purposeless, and stereotyped intermittent muscle movements or vocalizations.<sup>1</sup> Motor tics are often preceded by premonitory urges or uncomfortable sensations that are located at the site of the tic, and patients report that their tics relieve these uncomfortable sensations.<sup>1</sup> Tics can often initially be voluntarily suppressed, but the uncomfortable urges and sensations build until there is an uncontrollable impulse to release the tic.<sup>1</sup> Motor tics can be simple (such as twitching, eye blinking, head jerking) or complex (more complicated, purposeful-appearing movements, such as touching or tapping).<sup>1</sup> The spectrum of ocular tics includes blinking, winking, eye rolling, and staring.<sup>2</sup> Eye tics occur intermittently and can, to some degree,

be voluntarily suppressed. Tics are not associated with alterations in consciousness. These characteristics serve to distinguish ocular tics from the incessant, multidirectional gaze deviations of opsoclonus, dystonic oculogyric crises, and the tonic or clonic eyelid or ocular movements associated with seizures.<sup>2</sup>

Frequent blinking and eye rolling are a common reason for referral to pediatric ophthalmologists and pediatric neurologists; however, there is a paucity of literature regarding the natural history of ocular tics in children without known comorbid medical conditions. Most of the literature on ocular tic disorders focuses on characterization and treatment of ocular tics in patients with Tourette syndrome.<sup>2-8</sup> Tourette syndrome is a childhood onset condition characterized by multiple chronic (lasting >1 year) motor tics and at least one vocal tic. It is often associated with behavioral disorders such as obsessive-compulsive disorder (OCD) and attention deficit hyperactivity disorder (ADHD).<sup>1</sup> Ocular tics have also been associated with post-traumatic stress disorder, blepharospasm, social stressors, anxiety, autism, Asperger syndrome, streptococcal infection, Lesch-Nyhan disease, and mental retardation.<sup>9-13</sup> The strength of many of these associations is unclear; however, parents may be alarmed by the serious behavioral disorders associated with ocular tics. Establishing a prognosis for children with ocular tic disorders is important for families and health care providers. The purpose of this study is to report the prevalence of comorbid medical conditions and the

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Presented as a poster at the 39th Annual Meeting of the North American Neuro-Ophthalmology Society, Snowbird, Utah, February 9-14, 2013.

Submitted August 19, 2013.

Revision accepted November 8, 2013.

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1091-8531/\$36.00

<http://dx.doi.org/10.1016/j.jaaapos.2013.11.007>

longitudinal course of ocular tics in children evaluated in a pediatric neuro-ophthalmology practice.

## Subjects and Methods

This study was conducted in full accordance with all applicable Children's Hospital of Philadelphia research policies and procedures and all applicable federal and state laws and regulations including 45 CFR 46. The medical records of consecutive children (1 to <18 years of age) seen by a single physician (GTL) at the pediatric neuro-ophthalmology clinic of the Children's Hospital of Philadelphia from July 1993 to December 2011 were retrospectively reviewed to identify patients diagnosed with "ocular tics," "hemifacial spasm," "blepharospasm," "blinking," and "eye rolling." Patients ultimately diagnosed with ocular tics were included in this study; those diagnosed with hemifacial spasm were specifically excluded.

For this study, ocular tics were defined as (1) eye rolling, eyelid blinking, and eye widening; (2) repetitive, purposeless, and brief (lasting a matter of seconds) movements of the eyelids or globe that are not associated with additional seizurelike activity or altered consciousness; and (3) involuntary in nature, but at times partially suppressible. Eye blinking ocular tics were distinguished from dry eye–related blinking based on history and an absence of corneal epitheliopathy or tear film abnormality on examination. Detailed examinations of the ocular surface and conjunctiva were performed with a slit-lamp or pen light with magnification for each child in order to eliminate ocular allergy or conjunctivitis as possible explanations for ocular motility disturbances or excessive blinking. Given that glaucoma may masquerade as ocular tics in children, intraocular pressure measurements were performed for each patient via Goldmann applanation tonometry, Tono-Pen (Reichert Ophthalmic, Depew, NY), ICare rebound tonometry (ICare Finland Oy, Helsinki, Finland), or finger tensions, depending on the patient's age and level of cooperation. Because tics may be temporarily suppressed during clinical examination, we relied on the descriptions of the various tics provided by patients and their parents to supplement our clinical observations.

Children with an ocular ticlike disorder of repetitive eye movement (eg, oculogyric crisis, ocular flutter, or opsoclonus) due to secondary causes such as seizures, illicit drugs, medications, ocular allergies, cerebellitis, and neuroblastoma were excluded from this study. Patients with known neurological disorders at the time of initial visit were also excluded. Non-English-speaking patients were also excluded because they could not participate in the telephone follow-up portion of the study.

Contact information for the patients, patients' parent(s) and/or guardian(s) in the medical record was used to telephone the patient (if > 18 years of age), parent(s), and/or guardian(s). Informed consent for enrollment in the study was obtained from patients and their parents/guardians via telephone. Enrolled participants then answered a brief telephone questionnaire (e-Supplement 1, available at [jaapos.org](http://jaapos.org)), and their medical charts were reviewed for additional pertinent information. A waiver of consent was obtained from the institutional review board for eligible study candidates who could not be reached by telephone

after 3 consecutive attempts, and pertinent information was obtained from their records for the retrospective component of the study.

The following information was gleaned from the medical records of the initial neuro-ophthalmological visits: date of birth, sex, age at presentation to MD, age at onset of ocular tics, description of ocular tic (eg, eye rolling, frequent blinking, duration), presence of additional motor or vocal tics at presentation, association of ocular tics with stress, associated neurological and psychological comorbidities already identified at the time of initial evaluation (eg, Tourette syndrome, OCD, ADHD, seizure disorder), history of head trauma, history of recent strep infection, relevant family history (eg, family history of tics, Tourette syndrome, OCD, ADHD), medications taken to control ocular tics at the time of initial visit, history of stimulant medication use, and ocular examination findings (eg, dry eye, decreased visual acuity).

## Results

A total of 86 children between the ages of 1 and 18 years with ocular tics were evaluated during the study period. Of these, medical records from the initial diagnostic consultation could not be obtained for 15 children, and 12 patients with neurological disorders were excluded (3 patients with developmental and motor delays, 8 with a history of seizures, and 1 patient with hydrocephalus). Seven patients with possible secondary causes for their ocular tic disturbance were also excluded (5 with ocular surface allergies and 2 with medication-induced ocular tics). One patient with voluntary blepharospasm was also excluded.

The remaining 51 patients were eligible to participate in the study. Of these, 8 (16%) declined to participate and were excluded from both the retrospective and prospective components of the study. Valid phone numbers could not be obtained for 6 patients (12%). An additional 5 patients could not be reached via telephone after at least 3 attempts at communication (10%). Patients who could not be reached for follow-up survey were included only in the retrospective component of the study. We achieved a response rate of 63% (32/51) for our prospective telephone survey.

The clinical characteristics of our baseline retrospective cohort of 43 patients are given in Table 1. We relied on the historical descriptions of ocular tics or videos provided by patients and their parents to supplement our clinical observations for 15 patients who did not demonstrate ocular tic disturbances during their clinical examination. Of the 43 patients, 27 (63%) were male, consistent with previous epidemiological investigations that indicate a higher prevalence of tic disorders in male children.<sup>14</sup> The average age of our patients at presentation was 7.8 years (range, 1.2–18.5), and the average duration of ocular tic symptoms prior to initial presentation was 9.6 months. Blinking was the most common form of ocular tic, in 27 cases (63%), followed closely by eye rolling, in 22 cases (51%). On

Table 1. Clinical characteristics of retrospective cohort (n = 43)

Clinical demographics	Number
Males (%)	27 (63)
Mean age, years (range)	7.8 (1.2-18.5)
Mean duration of tics at presentation, years (range)	0.8 (0.0-4.2)
Eye rolling tics (%)	22 (51)
Eye blinking tics (%)	27 (63)
Eye widening tics (%)	1 (2)
Comorbidities at presentation	
Nonocular motor tics (%)	7 (16)
Vocal tics (%)	4 (9)
Nonocular motor tics and vocal tics (%)	2 (5)
Tourette syndrome (%)	0 (0)
ADHD (%)	1 (2)
OCD (%)	0 (0)

ADHD, attention deficit hyperactivity disorder; OCD, obsessive-compulsive disorder.

presentation, 7 children (16%) with ocular tics also experienced other nonocular motor tics, 4 (9%) had vocal tics, and 2 (5%) had both nonocular motor and vocal tics at presentation. None of the patients had been formally diagnosed with OCD or Tourette syndrome, but 1 patient in the retrospective cohort carried the diagnosis of ADHD at presentation.

The 11 patients who could not be reached by telephone were more likely to be male (9 [82%]) and slightly younger, with an average age of 6.5 years at presentation (range, 1.2-13.7). The majority of these patients had blinking tics (7 [64%]), while a large percentage had eye rolling (5 [45%]). One patient (9%) had a nonocular motor tic at presentation, while none of these children had vocal tics at presentation.

The clinical characteristics of our prospective (follow-up) cohort of 32 patients is provided in Table 2. Our follow-up cohort was 56% male, with an average age of 14.3 years (range, 4.2-30.8). The mean follow-up duration was 6.1 years for the entire cohort (range, 1.3-15.4 years). There was a trend toward a longer follow-up period in the cohort of children whose ocular tics resolved, with an average follow-up period of  $7 \pm 3.9$  years (standard deviation) for these children (range, 2.2-15.4 years). The average follow-up period of children whose ocular tics persisted was  $4.9 \pm 3.7$  years (range, 1.3-13.5 years). Fourteen patients (44%) reported persistence of their ocular tics at follow-up, of whom 10 stated that the tics had improved and 4 patients reported that they were stable since presentation. None of our patients experienced worsening of their ocular tics. Three (9%) patients developed new nonocular motor tics during the follow-up interval, while 5 (16%) developed new vocal tics. Four patients (13%) developed both new nonocular motor and vocal tics. One patient (3%) was formally diagnosed with Tourette syndrome, while 3 patients (9%) were diagnosed with ADHD during the follow-up period. No patients were diagnosed with OCD during this interval. Overall, 6 children from the initial retrospective cohort had both additional nonocular motor and vocal tics at some time period during the study, whether at presentation or during follow-up.

Table 2. Clinical characteristics of follow-up cohort (n = 32)

Clinical demographics	Number
Males (%)	18 (56)
Mean age, years (range)	14.3 (4.2-30.8)
Mean follow-up, years (range)	6.1 (1.3-15.4)
Persistence of ocular tics (%)	14 (44)
New comorbidities developed during follow-up	
Nonocular motor tics (%)	3 (9)
Vocal tics (%)	5 (16)
Nonocular motor tics and vocal tics (%)	4 (13)
Tourette Syndrome (%)	1 (3)
ADHD (%)	3 (9)
OCD (%)	0 (0)

ADHD, attention deficit hyperactivity disorder; OCD, obsessive-compulsive disorder.

Of the 14 patients with persistent ocular tics on follow-up, 2 (14%) had other motor tics at presentation, and 1 (7%) had vocal tics at initial presentation. Only 1 of these children had behavioral concerns. None of these patients were formally diagnosed with Tourette syndrome, OCD, or ADHD.

Of the 18 patients who did not have persistent ocular tics at follow-up, 4 (22%) had nonocular motor tics at presentation, and 3 (17%) had vocal tics at presentation. Three of these children had behavior/developmental concerns at presentation. One of the patients whose ocular tics eventually resolved was formally diagnosed with Tourette syndrome during the follow-up interval, and 3 children were diagnosed with ADHD during the follow-up interval. None of the children in this subset of patients were formally diagnosed with OCD.

## Discussion

Tic disorders are common, especially in children, and boys are preferentially affected.<sup>14</sup> The reported prevalence of individual tic disorders varies widely. A recent meta-analysis of 35 studies reporting international data collected from 1985 to 2011 suggests that Tourette syndrome, with a prevalence of <1% of school-aged children aged 6-15 years, forms one end of the tic disorder spectrum, while transient tic disorder, with a prevalence of nearly 3% of school-aged children, forms the other.<sup>14</sup> Numerous clinical studies have investigated chronic tic disorders and Tourette syndrome in children; however, ocular tics in the form of frequent blinking, eye rolling, and eye widening have been less frequently explored.<sup>4,10,15,16</sup>

In 2001 Coats and colleagues<sup>15</sup> evaluated 99 consecutive children that presented to a tertiary care ophthalmology practice for evaluation of excessive blinking. Each child received a comprehensive eye examination. The most common etiologies of excessive blinking were anterior segment/lid abnormalities (37%), "habit tics" (23%), and uncorrected refractive errors (14%).<sup>15</sup> A history of neurologic disease was present in 22 patients, but excessive blinking was only attributed to active neurological disease in 6 patients.<sup>15</sup> In 2 patients, excessive blinking led to the

diagnosis of Tourette syndrome; these 2 patients also presented with lip smacking.<sup>15</sup> The patients diagnosed with Tourette syndrome were not considered to have “habit tics” but rather primary central nervous system disease responsible for their blinking. In the study by Coats and colleagues,<sup>15</sup> the diagnosis of “habit tic” was often made in retrospect, after the problem had resolved spontaneously and no other explanation became apparent; the number may thus have been artificially inflated. The mean age of the 23 “habit tic” patients was 5.4 years.<sup>15</sup> Boys were more likely than girls to receive this diagnosis.<sup>15</sup> Of these patients, the “habit tics” resolved or improved at follow-up in 17 and were unchanged in 1 (2 were lost to follow-up).<sup>15</sup> Five patients reported exacerbation of blinking with stress, and 4 patients had intermittent facial twitches associated with their “habit tics.”<sup>15</sup>

Jung and colleagues<sup>16</sup> evaluated the frequency of tic disorders in 50 children <16 years of age who presented with the chief complaint of frequent eye blinking. These children were compared with a control group of 30 children who had neither frequent eye blinking nor any signs/symptoms of psychiatric illness. Detailed ophthalmic examinations were performed for each child. Tic disorders were diagnosed in 43 children (86%) with frequent eye blinking, and each of those children underwent a detailed psychiatric examination.<sup>16</sup> Transient tic disorder (tics lasting from 4 weeks to 1 year) was diagnosed in 39 patients, chronic tic disorder (motor or vocal tics, but not both, lasting at least 1 year) was diagnosed in 2 patients, and 2 patients were found to have Tourette syndrome.<sup>16</sup> No statistically significant difference in emotional/behavioral problems was found between the children with tic disorders and the control group.<sup>16</sup>

Unlike Jung and colleagues’ study, in which the majority of children were diagnosed with a simple transient tic disorder lasting <12 months, 44% of our patients continued to experience ocular tics over an average follow-up period of 6.1 years. It is possible that this discrepancy may be attributed to a difference in methodology between the studies. While Jung and colleagues suggest that 41 of their patients were directed to revisit the clinic in 6 months only if symptoms worsened or persisted, the design of the present study allowed active pursuit of follow-up data; patients were contacted even if they had not returned to the clinic for further medical management. Our study design enabled us to quantify the number of patients whose tics persisted over years, even in the absence of follow-up appointments. Of note, the DSM V criteria for tic disorders has changed the diagnosis of transient tic disorder to provisional tic disorder to minimize the premature dismissal of chronic tic disorders as transient.<sup>17</sup>

We conducted a subgroup analysis to compare the patients whose ocular tics resolved with patients whose tics persisted in order to determine whether any behavioral or developmental conditions noted at presentation might help predict the persistence of ocular tics. None of the 14 patients in our cohort with persistent ocular tics carried

the diagnosis of Tourette syndrome, OCD, or ADHD. Only 1 of these children had behavioral concerns and was diagnosed with defiant behavioral disorder prior to the initial visit. None of the 18 patients who had resolution of their ocular tics presented with the diagnosis of Tourette syndrome or OCD; however, 1 child had ADHD at presentation, and 3 had other behavioral/developmental concerns at presentation (including one “self-biter,” one who was described as “detailed and perseverative” with possible OCD tendencies, and one with a learning disability). Furthermore, one child with resolution of ocular tics was diagnosed with Tourette syndrome during follow-up, and 3 children were diagnosed with ADHD during follow-up. In our study, the children who had eventual resolution of their ocular tics seemed to be more likely to manifest behavioral/developmental problems at presentation than those whose tics persisted, and they were also more likely to receive a behavioral/developmental diagnosis on follow-up. However, the relatively small sample size of children with behavioral anomalies in our cohort makes it difficult to deduce a statistically meaningful relationship from this data.

Although only 1 child in our cohort was officially diagnosed with Tourette syndrome by a physician, at least 6 children (14%) experienced additional nonocular motor tics and vocal tics at some point during the study period. Given the fact that Tourette syndrome is defined as a disease of multiple motor and one or more vocal tics lasting more than 1 year, it is possible that some of our patients would have met the diagnostic criteria for Tourette syndrome if they had they been more formally evaluated by a neurologist or a psychiatrist. Ocular tics are a common feature of Tourette syndrome. Martino and colleagues<sup>2</sup> found that 94.8% of 212 adult and pediatric patients with Tourette syndrome reported ocular tics in their lifetime; 78.3% reported eye movement tics, while 91.5% reported eyelid/eyebrow movement tics (raising eyebrows, blinking, or winking). They reported that sex, age at first tic onset, disease duration, comorbidity for ADHD and OCD, and exposure to pharmacological treatment did not differ between patients who reported and who did not report ocular tics.<sup>2</sup> Martino and colleagues<sup>2</sup> also found that ocular tics tended to manifest earlier than other tics in patients with Tourette syndrome, which is in accord with natural history studies of Tourette syndrome suggesting that tics involving the eye region are often the first to appear.<sup>2</sup> While ocular tics may be isolated and transitory in nature, they may also be the heralding symptom of Tourette syndrome; careful longitudinal follow-up may be warranted for accurate diagnosis and management.

The main strengths of our study include our high response rate and extended duration of longitudinal follow-up. It was limited by a design that did not allow for the professional clinical evaluation of the severity and persistence of ocular tics over time and instead relied on the observations of patients’ parents and caretakers for follow-up data, which may be subject to biases.

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### Eye on the Arts—the Arts on the Eye

Outer beauty is inner beauty made visible, and it manifests itself in the light that flows from our eyes. It doesn't matter if a person is badly dressed or doesn't conform to our idea of elegance, or even if he isn't concerned about impressing other people. The eyes are the mirror of the soul and reflect everything that seems to be hidden; and, like a mirror, they also reflect the person looking into them. So if the person looking into someone's eyes has a dark soul, he will see only his own ugliness.

—Paulo Coelho, *Manuscript Found in Accra* (New York: Alfred A. Knopf, 2013), 59-60.

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