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Observational Study

The clinical characteristics of pediatric patients with treatment-refractory Tourette syndrome: An evidence-based survey in a Chinese sample

Clinical characteristics of pediatric treatment-refractory TS

Ying Li, Junjuan Yan, Yong-Hua Cui

Abstract

BACKGROUND

Tourette syndrome (TS) is a complex neurodevelopmental condition marked by tics, as well as a variety of psychiatric comorbidities, such as obsessive-compulsive disorders (OCDs), attention deficit hyperactivity disorder (ADHD), anxiety and self-injurious behavior. Some patients with TS might develop to be treatment-refractory Tourette syndrome (TRTS). However, there is no confirmed evidence in pediatric patients with TRTS.

AIM

In this study, we aimed to investigate the clinical characteristics of TRTS in a Chinese pediatric sample.

METHODS

A total of 126 pediatric patients aged 6–12 years with TS were identified, including 64 TRTS and 62 non-TRTS patients. The Yale Global Tic Severity Scale (YGTSS), Premonitory Urge for Tics Scale (PUTS), and Child Behavior Checklist (CBCL) were used to assess these two groups and compared the difference between the TRTS and non-TRTS.

RESULTS

When compared with the non-TRTS group, we found that the age of onset for TRTS was younger ($p < 0.001$), and the duration of illness was longer ($p < 0.001$). TRTS was more often caused by psychosocial ($p < 0.001$) than physiological factors, and coprolalia and inappropriate parenting style were more often present in the TRTS group ($p < 0.001$). The TRTS group showed a higher level of premonitory urge ($p < 0.001$), a lower intelligence quotient (IQ) ($p < 0.001$) and a higher percentage of family history of TS. The TRTS patients demonstrated more problems ($p < 0.01$) in the “Uncommunicative”,

“Obsessive-Compulsive”, “Social-Withdrawal”, “Hyperactive”, “Aggressive”, and “Delinquent” in the boys group, and “Social-Withdrawal” ($p = 0.02$) in the girls group.

CONCLUSION

Pediatric TRTS might show an earlier age of onset age, longer duration of illness, lower IQ, higher premonitory urge and higher comorbidities with ADHD-related symptoms and OCD-related symptoms. We need to pay more attention to the social communication deficits of TRTS.

Key Words: Treatment-refractory Tourette syndrome; YGTSS; CBCL; PUTS; Social withdrawal; Obsessive-compulsive disorder

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Core Tip: This study provides important evidence of treatment-refractory TS among Chinese patients due to the current shortage of studies based on Chinese samples. We found that the onset age of pediatric patients with TRTS might be younger, and they might have a longer duration of illness, have a lower IQ, and have a higher premonitory urge, which often fluctuates due to psychosocial factors. Moreover, TRTS might suffer more emotional and behavioral problems including social communication deficits (such as uncommunicative and social withdrawal), ADHD-related symptoms (hyperactive, aggressive, and delinquent) and obsessive-compulsive symptoms. These were the basic clinical characteristics of TRTS based on Chinese pediatric patients. Unravelling these clinical characteristics is beneficial for the early diagnosis and treatment of TRTS.

4 INTRODUCTION

Tourette syndrome (TS) is a complex neurodevelopmental condition marked by tics, as well as a variety of psychiatric comorbidities, such as obsessive-compulsive disorders (OCDs), attention deficit hyperactivity disorder (ADHD), anxiety and self-injurious behavior [1,2]. The worldwide prevalence of tic disorders (TDs) ranges from 0.4 to 1.5% [3]. In a recent report, the prevalence of TS in children and adolescents in China was 0.4% [4]. Some patients with TS fail to respond to traditional treatment, and this condition is referred to as “treatment-refractory Tourette syndrome” (TRTS) [5]. To the best of our knowledge, refractory to “traditional treatments” (i.e., medicine treatment or behavioral treatment) implies failure to respond to (or have severe side effects from) alpha-adrenergic agonists, typical and atypical antipsychotics, and benzodiazepine, as well as behavioral therapies (i.e., habit-reversal training and exposure type therapy) [6]. It should be noted that one of the unresolved issues is the definition of what constitutes treatment-refractory TS; the most likely reason is the lack of the robust clinical features of TRTS, especially the features associated with the co-occurring other mental disorders [7].

However, different criteria are used to define TRTS in different countries [8]. The most commonly used criterion for TRTS was from the International Deep Brain Stimulation Registry and Database for Gilles de la Tourette Syndrome [9]. It recommended that TRTS should be the major source of disability, with a YGTSS score of 35/50, failure of conventional therapies (medications from 3 pharmacologic classes), and a trial of CBIT if feasible. European clinical guidelines for Tourette syndrome also reported the criteria of TRTS for European countries [10]. However, no Chinese version of the TRTS criteria has been described. The most likely reason is the lack of confirmed evidence related to TRTS, especially for Chinese patients. Moreover, the different criteria for TRTS were established mostly based on the clinical characteristics of adult patients with Tourette syndrome [8,9]. However, there is no evidence focusing on pediatric patients with TRTS.

Therefore, we need more confirmatory evidence about the clinical characteristics of TRTS. There are some reasons why we need to investigate the clinical characteristics

of TRTS. First, TS is frequently encountered by both psychiatrists and neurologists, indicating that TS holds a unique status as a quintessentially neuropsychiatric condition at the interface between neurology (movement disorder) and psychiatry (behavioral condition) [11]. However, few studies have focused on the behavioral and emotional components of TRTS. Second, TS onset occurs between the ages of six and eight; tics typically start simple and become more complex toward the teenage years [12, 13]. Identifying the “indicators” of TRTS in the early stage may help in the treatment of these patients [14]. However, few studies have focused on these potential “indicators” of TRTS. For example, premonitory urge was suggested as an indicator for the severity of tic symptoms [15-17], and confirmatory evidence is required to ascertain if it is also an important sign for TRTS. Third, OCD, ADHD, anxiety and depression disorders were the top four comorbidities of TS [11], especially TRTS [18], but no evidence links these comorbidities to pediatric TRTS. Fourth, some authors suggested that there might be different subtypes of TS [19, 20]. Whether TRTS is different from “pure TS” (only tic symptoms without comorbidities) is unknown. More evidence is needed to explore these differences, especially at the early stage of TRTS. Taken together, we might need more evidence about the clinical characteristics of TRTS, especially in pediatric patients.

In addition, the Child Behavior Checklist (CBCL) is one of the most important tools to identify the emotional and behavioral profiles of different mental disorders [21]. It has been suggested that the CBCL can be used to identify ADHD-related [22], obsessive-compulsive [23], anxiety [24] and depression symptoms [25]. It might provide different dimensions of clinical characteristics for TRTS, which can distinguish it from other types of TS.

Therefore, this study aims to examine the clinical characteristics of TRTS in a Chinese pediatric population. We will compare the clinical characteristics (i.e., the onset of tic age, duration of illness, intelligence quotient (IQ), and behavioral and emotional problems) of TRTS with non-TRTS. Furthermore, the locations and the frequency of tic onset in TRTS will be reported. The CBCL will be used to present the different dimensions of mental problems between TRTS and non-TRTS. We hypothesize that

TRTS patients might show more severe behavioral and emotional problems, especially in the dimensions of obsessive-compulsive, ADHD-related (i.e., hyperactive, aggressive, and delinquent) and depression symptoms. This study will provide important information for a Chinese version of the TRTS criteria, especially for pediatric patients.

MATERIALS AND METHODS

Participants

All participants were recruited from the Department of Psychiatry in Beijing Children's Hospital in China from October 1, 2018, to January 1, 2021. Both inclusion and exclusion criteria of TS patients were developed. The inclusion criteria were as follows: 1) aged from 6 to 12 years and 2) met the Tourette syndrome diagnostic criteria according to the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5) [26]. The exclusion criteria were as follows: (1) epilepsy or any known comorbid brain medical conditions; (2) IQ less than 80; and (3) serious physical illness.

The criteria for TRTS were as follows: (1) nonresponsive to trials of medications from dopamine antagonists (typical and atypical) or other medications (i.e., alpha-adrenergic or benzodiazepine) at adequate dosage for at least six months; (2) a YGTSS severity total score greater than 35; and (3) failure following 12 sessions of habit reversal training (if the included TS patients did not meet the criteria of TRTS, they were identified as the non-TRTS group).

The ethics committee of the Beijing Children's Hospital of Capital Medical University approved this study, and we also obtained written informed consent from the parents or guardians of the enrolled children and adolescents.

Measures

Basic clinical information: A basic information list was used to identify the baseline clinical information, including age, sex, age of onset, duration of illness, factors associated with the fluctuation of tic symptoms (psychosocial factors, i.e., negative

emotion or stress; physiological factors, i.e., respiratory tract infection or allergy symptoms), locations of onset of tic, coprolalia frequency, and inappropriate parenting style, among others.

Yale Global Tic Severity Scale (YGTSS): The YGTSS is a semi-structured scale rated by a clinician or trained interviewer. It was developed for assessing the tics observed within 1 week before the assessment [27, 28]. The five dimensions included in the YGTSS are the number, frequency, intensity, complexity, and interference. The total YGTSS score (range: 0–100) was derived by summing the tic severity ranging between 0 and 50 (motor tics range = 0–25 and vocal tics range = 0–25) and the impairment rating score (range = 0–50). The YGTSS is a widely used scale with excellent reliability and validity for assessing children and adolescents with TD [29].

Premonitory Urge for Tics Scale (PUTS): The PUTS is a nine-item self-report questionnaire measuring premonitory sensations in individuals with tics [30]. Each item is scored from 1 (not at all true) to 4 (very much true). The total score is computed by summing the nine items. Total scores range from 9 to 36, where higher scores represent greater severity of premonitory urges. The PUTS has demonstrated good internal consistency, test-retest reliability, and construct validity among adolescents between 11 and 16 years of age [31].

The Child Behavior Checklist (CBCL): The CBCL is a widely used questionnaire to assess behavioral and emotional problems. It is often used as a diagnostic screener. The Chinese version of the CBCL contains 118 specific behavioral and emotional problem items and two open-ended items. Each symptom question in the CBCL was scored 0 (not true, as far as you know), 1 (somewhat or sometimes true), and 2 (very true or often true). Liu completed a regional survey in Shandong and reported that the two-week test-retest reliability was 0.90 in 30 children, and the internal consistency as measured by Cronbach's α was 0.93 [32, 33]. Cronbach's α was also calculated in the present study,

and it was 0.87 for the total scale. The CBCL was completed by the parents or other caregivers for a given child or adolescent. In young patients, the CBCL included 8 subscales in the boys' group (including the Schizoid, Depressed, Uncommunicative, Obsessive-Compulsive, Somatic Complaints, Social-Withdrawal, Hyperactive, Aggressive and Delinquent) and 9 subscales in girls' groups (including the Depressed, Social-Withdrawal, Somatic Complaints, Schizoid-Obsessive, Hyperactive, Sex Problem, Delinquent, Aggressive, and Cruel).

In addition, the Wechsler Intelligence Scale for Children-4th Edition (WISC-IV) was used to calculate the full intelligence quotient (IQ) [34]. All the included participants were outpatients. The assessments were performed by child psychiatrists after diagnosis was completed.

Statistical analysis

We used the Statistical Package for the Social Sciences for Windows (SPSS Inc., Chicago, IL, USA, v25.0) to perform the statistical analyses. Descriptive statistics were performed to identify the basic clinical information, and t tests or χ^2 tests were used to compare the different variables of different TS groups. A p value of 0.05 was set as the significance threshold.

RESULTS

The basic information of the whole sample

The total sample comprised 126 patients diagnosed with TS, with a male percentage of 73.02%. The mean age of the included patients was 9.24 ± 2.06 years (range 6–12 years old), and the mean duration of illness was 3.83 ± 2.52 years. A total of 64 patients with TS were identified as TRTS, while 62 non-TRTS patients were also included. For more details, see Figure 1.

Insert Figure 1 here

Clinical characteristics of the TRTS

After comparing the basic clinical characteristics of the TRTS group with those of the non-TRTS group, we found that in the TRTS group, the onset age was lower ($p < 0.001$), and the duration of illness was longer than that in the non-TRTS group ($P = 0.02$). Children in the TRTS group self-reported more fluctuations in conjunction with psychosocial rather than physiological factors TRTS ($p < 0.001$); coprolalia was more often present in the TRTS group than in the non-TRTS group ($p < 0.001$); and the TRTS group showed more severe functional impairment ($p < 0.001$). More patients with TRTS showed a positive family history of TS ($P = 0.02$). The TRTS group showed a lower level of premonitory urge ($p < 0.001$) and a higher level of tic symptoms ($p < 0.001$) than the non-TRTS group. Lower IQ was identified in the TRTS group ($p < 0.001$). In addition, the TRTS group showed more severe tic symptoms and premonitory urges ($p < 0.001$). For more details, see Table 1.

Insert Table 1 here

The locations of first-onset tic symptoms in the TRTS group

We listed the locations of the first onset of tic symptoms, and the order was the face (48.44%), throat (18.75%), shoulder (12.50%), abdomen (10.93%) and upper/Lower limbs (9.38%). For more details, see Figure 2.

Insert Figure 2 here

The most frequent tic symptoms in the TRTS group

We listed the top five motor and vocal tic symptoms that were frequently present in TRTS patients. The top five motor tic symptoms included head shaking/nodding, blinking, shrugging, hand moving and mouth moving, while the vocal tic symptoms included clearing the throat, coprolalia, repetitive speech, imitating speech and cough. For more details, see Figure 3.

Insert Figure 3 here

The emotional and behavioral profiles in the TRTS group

We found that the total CBCL score was higher in the TRTS group ($p < 0.001$). We also found that the TRTS patients demonstrated more problems in the “Uncommunicative” ($p < 0.001$), “Obsessive-Compulsive” ($P = 0.001$), “Social-Withdrawal” ($p < 0.001$), “Hyperactive” ($p < 0.001$), “Aggressive” ($P = 0.002$) and “Delinquent” ($p < 0.001$) subscales of the CBCL in the boys group and “Social-Withdrawal” ($P = 0.02$) in the girls group. For more details, see Table 2 and Table 3.

Insert Table 2 and Table 3 here

DISCUSSION

In the present study, we found that pediatric patients with TRTS always develop at an earlier age, have a longer duration of illness, have a lower IQ and have a higher premonitory urge, which often fluctuates due to psychosocial factors. In addition, the incidence of coprolalia seemed higher in the TRTS group. The locations of tics often occur at the face, then the throat and shoulder in TRTS; the most common motor tics were nodding or shaking the head, blinking, or shoulder shrugging, while the vocal tics commonly include clearing the throat, coprolalia, and repeated speech. These were the basic clinical characteristics of TRTS based on Chinese pediatric patients. Unraveling these clinical characteristics is beneficial for the early diagnosis and treatment of TRTS.

Based on the results of this study, psychiatric components might be robust features of TRTS. Cavanna *et al*^[11] performed a review of the psychopathological spectrum of TS and reported that the psychiatric components of TS included OCD, ADHD and affective disorders. A large cross-sectional survey including 1001 TSs found that 85.7% of TSs had at least one psychiatric disorder, and 57.7% had 2 or more psychiatric disorders^[35]. It seems that the most common psychiatric disorders were ADHD and OCD^[6].

In this study, we found that children diagnosed with TRTS might suffer more emotional and behavioral problems than those diagnosed with non-TRTS. These included social communication deficits (such as uncommunicative and social withdrawal), ADHD-related symptoms (hyperactive, aggressive, and delinquent) and obsessive-compulsive symptoms. The high level of ADHD-related symptoms and

obsessive-compulsive symptoms in TRTS suggest that the comorbid psychiatric conditions of ADHD and OCD seem to be the main clinical characteristics of TRTS. Comorbid ADHD might increase the risk of impulsive behavior (such as running the red light) [36], and these might develop into new psychosocial factors that can cause fluctuations in tic symptoms in TS. Comorbid ADHD might also result in the failure of psychotherapeutic interventions for TS [37]. Moreover, the severity of obsessive-compulsive symptoms in TS was one of the most important predictors of the severity of tic symptoms [38]. Taken together, the comorbid ADHD and OCD might make the traditional treatment of TS harder, which is the most likely reason for the treatment refractoriness of TS.

In addition, in the present study, we found that premonitory urge might be one of the indicators of TRTS. Indeed, obsessive-compulsive symptoms also showed an association with premonitory urge in TS [39]. It seemed that premonitory urge could predict the severity of tic symptoms [40]. This finding suggested that we need to pay attention to the assessment of premonitory urge at the early stage of treatment of TS, which might be the indicators of which might develop to TRTS.

However, we hypothesized that patients diagnosed with TRTS might have more depressive symptoms, but the opposite result was found. Notably, two aspects of social communication, uncommunicative and social withdrawal, were prominent among children diagnosed with TRTS. Regarding the social communication deficits of TS, a recent study reported that TS showed significantly higher mean Social Communication Questionnaire (SCQ) scores than the general population [41]. These results suggested that more attention should be given to social communication deficits in TS.

Based on the clinical characteristics of TRTS, a younger onset age of tics, a longer duration of illness, comorbidities and social communication deficits may be indicators for TRTS. Up to 70% of the troubles caused by nontic-related functional impairment mostly result from ADHD or OCD [42]. The functional impairment could be caused by both the tics and the comorbidities. Moreover, psychiatric comorbidities might lead to less effective medical treatment or psychotherapeutic treatment [6]. It is indicated that

practitioners should pay more attention to early screening and properly treat the comorbidities of patients with TRTS. This could improve the global function and prognosis of TRTS patients with comorbidities. In addition to medicine and psychotherapeutic treatment, there are also some other treatment options. Repetitive transcranial magnetic stimulation (rTMS) can significantly relieve tic and obsessive-compulsive symptoms in TS patients in a meta-analysis [43]. Deep brain stimulation was carefully recommended to patients with TRTS for more consideration of its efficacy and tolerability [44].

In this study, we investigated the clinical characteristics of TRTS, which will provide conforming evidence to the definition of the Chinese version of the criteria for TRTS. According to our study, TRTS might be an important subtype of TS, which differs from “pure TS”. The following aspects might be indicators of pediatric TRTS: an earlier age of onset, longer duration of illness, higher incidence rates of complicated tics such as coprolalia, higher premonitory urge, lower IQ and more severe functional impairment than other “pure TSs”. Moreover, TRTS is more frequently associated with ADHD-related symptoms, obsessive-compulsive symptoms, and social communication deficits. Cumulatively, these clinical characteristics provide important information for the definition of TRTS in China, especially for pediatric patients.

What may account for the social communication deficits in children diagnosed with TRTS? There might be the following three factors. First, both motor and vocal tic symptoms last longer and are more severe in TRTS than in other types of TS. For example, we found that the incidence rates of coprolalia were higher, which brought self-stigma pressure to the patients upon receipt of negative comments such as being called “freak” by peers. A study reported that stigma, social maladjustment, ⁸social exclusion, bullying, and discrimination are considered to be caused in large part by misperceptions of the disorder by teachers and peers [45]. Second, psychosocial factors have a huge impact on TRTS. The high comorbidity with ADHD makes children with TRTS suffer poorer test performance and rejections from peers or teachers at school [46]. Moreover, we found that children with TRTS might experience more negative parenting

styles, indicating that they might suffer lower self-esteem and become socially withdrawn [47]. Third, it has been confirmed that social cognition deficits can also influence the social communication function of TS [48]. Overall, it indicated the importance of social communication deficit-related symptoms for TRTS.

However, in previous studies, we focused more on ADHD and obsessive-compulsive symptoms in TRTS, and social communication-related problems seemed to be neglected. It should be noted that social communication deficits are crucial signs of functional impairment [45], suggesting that we also need to assess social communication deficits during the assessment of function in TRTS. Therefore, we should pay more attention to social communication deficits in TRTS regardless of the assessment or the treatment.

Some of the following limitations existed in this study. First, the sample size should be larger to increase the effect size. Second, the evaluation tool was limited to the Child Behavior Checklist (CBCL). Although the CBCL can assess the emotional and behavioral problems associated with TS, more specific tools should be included to evaluate TS comorbidities. Third, this study was a cross-sectional study, and a longitudinal follow-up study will provide more confirmatory evidence in the future.

CONCLUSION

Pediatric TRTS might show an earlier age of onset age, longer duration of illness, lower IQ, higher premonitory urge and higher comorbidities with ADHD-related symptoms and OCD-related symptoms than 'pure TS'. Moreover, TRTS showed more social communication deficits that need to be covered in both the assessment and treatment of TRTS. TRTS might be one of the subtypes of TS. We need to develop a proper Chinese version definition of the TRTS in the future, especially for pediatric patients.

ARTICLE HIGHLIGHTS

Research background

4

Tourette syndrome (TS) is a complex neurodevelopmental condition marked by tics, as well as a variety of psychiatric comorbidities, such as obsessive-compulsive disorders (OCDs), attention deficit hyperactivity disorder (ADHD), anxiety and self-injurious behavior. Some patients with TS fail to respond to traditional treatment, and this condition is referred to as “treatment-refractory Tourette syndrome” (TRTS). To the best of our knowledge, refractory to “traditional treatments” (i.e., medicine treatment or behavioral treatment) implies failure to respond to (or have severe side effects from) alpha-adrenergic agonists, typical and atypical antipsychotics, and benzodiazepine, as well as behavioral therapies (i.e., habit-reversal training and exposure type therapy). It should be noted that one of the unresolved issues is the definition of what constitutes treatment-refractory TS; the most likely reason is the lack of the robust clinical features of TRTS, especially the features associated with the co-occurring other mental disorders. However, different criteria are used to define TRTS in different countries. However, no Chinese version of the TRTS criteria has been described. The most likely reason is the lack of confirmed evidence related to TRTS, especially for Chinese patients. Moreover, the different criteria for TRTS were established mostly based on the clinical characteristics of adult patients with Tourette syndrome. However, there is no evidence focusing on pediatric patients with TRTS.

Research motivation

We need more confirmatory evidence about the clinical characteristics of TRTS. There are some reasons why we need to investigate the clinical characteristics of TRTS. First, TS is frequently encountered by both psychiatrists and neurologists, indicating that TS holds a unique status as a quintessentially neuropsychiatric condition at the interface between neurology (movement disorder) and psychiatry (behavioral condition). However, few studies have focused on the behavioral and emotional components of TRTS. Second, TS onset occurs between the ages of six and eight; tics typically start simple and become more complex toward the teenage years. Identifying the “indicators” of TRTS in the early stage may help in the treatment of these patients.

However, few studies have focused on these potential “indicators” of TRTS. For example, premonitory urge was suggested as an indicator for the severity of tic symptoms, and confirmatory evidence is required to ascertain if it is also an important sign for TRTS. Third, OCD, ADHD, anxiety and depression disorders were the top four comorbidities of TS, especially TRTS, but no evidence links these comorbidities to pediatric TRTS. Fourth, some authors suggested that there might be different subtypes of TS. Whether TRTS is different from “pure TS” (only tic symptoms without comorbidities) is unknown. More evidence is needed to explore these differences, especially at the early stage of TRTS. Taken together, we might need more evidence about the clinical characteristics of TRTS, especially in pediatric patients.

Research objectives

Therefore, this study aims to examine the clinical characteristics of TRTS in a Chinese pediatric population. We will compare the clinical characteristics (i.e., the onset of tic age, duration of illness, intelligence quotient (IQ), and behavioral and emotional problems) of TRTS with non-TRTS. Furthermore, the locations and the frequency of tic onset in TRTS will be reported. The CBCL will be used to present the different dimensions of mental problems between TRTS and non-TRTS. We hypothesize that TRTS patients might show more severe behavioral and emotional problems, especially in the dimensions of obsessive-compulsive, ADHD-related (i.e., hyperactive, aggressive, and delinquent) and depression symptoms. This study will provide important information for a Chinese version of the TRTS criteria, especially for pediatric patients.

Research methods

³ All participants were recruited from the Department of Psychiatry in Beijing Children’s Hospital in China from October 1, 2018, to January 1, 2021. Both inclusion and exclusion criteria of TS patients were developed. A total of 126 pediatric patients aged 6–12 years with TS were identified, including 64 TRTS and 62 non-TRTS patients. The ⁶ Yale Global

Tic Severity Scale (YGTSS), Premonitory Urge for Tics Scale (PUTS), and Child Behavior Checklist (CBCL) were used to assess these two groups and compared the difference between the TRTS and non-TRTS. We used the Statistical Package for the Social Sciences for Windows (SPSS Inc., Chicago, IL, USA, v25.0) to perform the statistical analyses. Descriptive statistics were performed to identify the basic clinical information, and t tests or χ^2 tests were used to compare the different variables of different TS groups. A p value of 0.05 was set as the significance threshold.

Research results

When compared with the non-TRTS group, we found that the age of onset for TRTS was younger ($p < 0.001$), and the duration of illness was longer ($p < 0.001$). TRTS was more often caused by psychosocial ($p < 0.001$) than physiological factors, and coprolalia and inappropriate parenting style were more often present in the TRTS group ($p < 0.001$). The TRTS group showed a higher level of premonitory urge ($p < 0.001$), a lower intelligence quotient (IQ) ($p < 0.001$) and a higher percentage of family history of TS. The TRTS patients demonstrated more problems ($p < 0.01$) in the “Uncommunicative”, “Obsessive-Compulsive”, “Social-Withdrawal”, “Hyperactive”, “Aggressive”, and “Delinquent” in the boys group, and “Social-Withdrawal” ($p = 0.02$) in the girls group.

Research conclusions

Pediatric TRTS might show an earlier age of onset age, longer duration of illness, lower IQ, higher premonitory urge and higher comorbidities with ADHD-related symptoms and OCD-related symptoms than ‘pure TS’. Moreover, TRTS showed more social communication deficits that need to be covered in both the assessment and treatment of TRTS. TRTS might be one of the subtypes of TS. We need to develop a proper Chinese version definition of the TRTS in the future, especially for pediatric patients.

Research perspectives

In previous studies, we focused more on ADHD and obsessive-compulsive symptoms in TRTS, and social communication-related problems seemed to be neglected. It should be noted that social communication deficits are crucial signs of functional impairment, suggesting that we also need to assess social communication deficits during the assessment of function in TRTS. Therefore, we should pay more attention to social communication deficits in TRTS regardless of the assessment or the treatment.

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