

Correlation between premonitory urges and tic symptoms in a Chinese population with tic disorders

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ABSTRACT

Importance: Tics usually start around 4–6 years old and affect about 1% of school-age children. Premonitory urges (PUs) are sensory phenomena that precede tics and are often described as unpleasant feelings. Recent evidence supports a relationship between PUs and tic severity, but reports are conflicting. In addition, there is no report of PUs in the Chinese population.

Objective: To investigate the correlation between PUs and tic symptoms in the Chinese population with tic disorders.

Methods: We recruited 252 Chinese individuals with chronic tic disorders (age 5–16 years). The Yale Global Tic Severity Scale (YGTSS) was used to assess tic symptoms, and the Premonitory Urge for Tics Scale (PUTS) was used to assess PUs. We calculated Spearman correlations between PUTS and YGTSS scores, and constructed a linear regression model to predict the tic symptom severity by PUs.

Results: There was a significant positive correlation between PU severity (PUTS scores) and motor tic severity, total tic severity, tic-caused impairment (YGTSS scores) ($P < 0.05$). PU severity was a significant positive predictor of tic symptom severity (standardized beta coefficient = 0.174, $t = 2.786$, $P = 0.006$).

Interpretation: We provide evidence for a correlation between PUs and tic symptoms. PU severity predicts tic symptom severity. Further research on PUs is needed to clarify the shared brain mechanism with tics, and their role in tic expression. A suitable tool to assess PUs in younger children is also needed.

KEYWORDS

Tics, Premonitory urge, Tourette syndrome, Premonitory Urge for Tics Scale (PUTS)

INTRODUCTION

Tics are sudden, brief, involuntary, repetitive motor movements or vocalizations that usually occur in bouts and show variable frequency, intensity, and form.¹ Tics usually first manifest around 4–6 years, affecting approximately 1% of school-age children, mainly males.² Premonitory

urges (PUs) are sensory phenomena that precede tics.³ Many patients experience unpleasant or uncomfortable feelings of energy, tension, itchiness and pressure, which have been variously described as “just right perceptions” “premonitory sensory phenomena” and “sensory tics”.^{4,5} PUs is reported to occur on over 90% of patients with Tourette syndrome (TS),^{3,6,7} and seem to be an initial and

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necessary process in the expression of tic symptoms.⁸

Recent evidence supports a relationship between PUs and tic severity.^{6,7,9-13} However, contradictory results also exist, as several studies have failed to find a correlation between PUs and tic severity.^{14,15} Possible reasons for this inconsistency are differences in age and tic disorder stage across study samples.¹⁰ These findings highlight the need for further studies.

Furthermore, behavior therapy for tic disorders has been recommended as the first-line treatment for TS.^{16,17} Habit reversal training is one of the most important behavioral therapies for tic disorders, and the first stage of this therapy is to detect PUs.¹⁸ Moreover, the insula, anterior cingulate cortex, and supplementary motor cortex are associated with the generation and expression of PUs.^{19,20} Interestingly, all these brain areas are part of the cortico-striatal-thalamo-cortical circuit, which provides a framework for understanding tic symptoms.²¹

A greater understanding of the sensory accompaniments of tics would improve our understanding of the pathophysiology of tic disorders, and provide new potential treatment options. In addition, there is no report of PUs in the Chinese population. Therefore, in present study, we recruited a Chinese sample to explore the relationship between PUs and tic symptoms.

METHODS

Ethical approval

This research was approved by the Ethics Committee of Beijing Children's Hospital. Written informed consents were obtained from all the guardians of the participants.

Participants

The study comprised 252 participants from outpatient department of Beijing Children's Hospital from August 2019 to January 2020. The inclusion criteria were: (1) diagnosed with Tourette's disorder or persistent (chronic) motor or vocal tic disorder according to the *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-V)*; (2) having tic episode during the 7 days before the interview; (3) aged between 5–16 years. The exclusion criteria were: (1) having severe neurological disorders (e.g. seizures, autism, and severe intellectual disability); (2) treatment for other medical conditions (e.g. asthma and infections); (3) inability to understand the psychometric scales; (4) hard to communicate.

Assessment scales

The Yale Global Tic Severity Scale (YGTSS) is a semi-structured interview to assess the nature and severity of motor and vocal tics in recent 7 days.²² Tics are evaluated according to their number, frequency, intensity,

complexity, and interference. Maximum scores are 50 for tics (25 for motor and 25 for vocal tics) and 50 for tic-caused impairment, yielding a total maximum score of 100. The YGTSS is a widely used scale with excellent psychometric properties.

The Premonitory Urge for Tics Scale (PUTS) is a nine-item questionnaire that measures premonitory sensations in individuals with tics.⁹ Each item is scored from 1 (not at all true) to 4 (very much true). The total score is obtained by summing scores on the nine items. Thus, total scores range from 9 to 36; higher scores indicate more frequent PUs. The PUTS has demonstrated good internal consistency, test-retest reliability, and construct validity among children and adults.^{6,9,13}

Two independent child psychiatrists were invited to perform the assessment of tic symptoms and PUs; the intraclass correlation coefficient was over 0.85. The locations of tic symptoms were also recorded.

Statistical analysis

Data are presented as mean \pm standard deviation (SD). Because no normality was found on the ordinal data of scales, Spearman correlation coefficients between the PUTS scores and YGTSS subscale scores were calculated. A linear regression model was constructed to predict the tic symptoms severity by PUs. A *P* value <0.05 was considered to be statistically significant. Statistical analyses were performed using SPSS (version 25.0, SPSS Inc., Chicago, IL, USA).

RESULTS

Demographic data

Participants were 204 boys and 48 girls, with a mean age of 9.5 ± 2.1 years (range 5–16). The mean duration of illness was 2.7 ± 1.6 years (range 1–9), and the mean age of tic onset was 6.88 ± 1.61 years (range 1.5–13.0). About 23 participants (9.1%) reported a positive family history of tics.

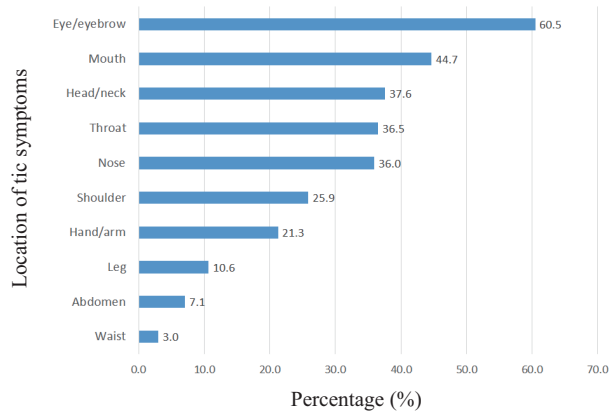
Characteristics of tic symptoms

The locations of tic symptoms are shown in Figure 1. The eyes/eyebrow, mouth, head/neck, throat, and nose were the most frequent locations for tics. Nearly 96.0% of participants reported motor tics during the 7 days before the interview. The most common types of motor tics were eye blinking, eye rolling, nose twitching, mouth opening, mouth twitching, head jerks, and shoulder jerks. About 61.1% of participants had vocal tics during the 7 days before the interview. Throat clearing, coughing and sniffing were the most common types of vocal tics; 41 participants had vocal tics of syllables; 5 participants had coprolalia; 1 participant had stammer.

TABLE 1 The PUTS and YGTSS scores of the patients with tic disorders

Variable	Mean	SD	Minimum	Maximum	Kurtosis	Skewness
PUTS	12.96	3.23	9	26	0.576	0.546
YGTSS total score	22.81	9.20	6	63	1.518	0.864
Total tic severity	19.63	6.47	6	38	-0.827	0.157
Impairment	3.21	5.32	0	30	2.451	1.555

PUTS, Premonitory Urge for Tics Scale; YGTSS, Yale Global Tic Severity Scale; SD, standard deviation.

**FIGURE 1** Occurrence rates of tic symptom locations in the population with tic disorders.

Assessment of PUs and tic symptom severity: PUTS and YGTSS scores

A total of 176 participants (69.8%) reported PU experiences. Table 1 shows means, standard deviations, minimums, maximums, kurtosis, and skewness of PUTS and YGTSS scores.

Correlations between PUs and tic symptom severity

Spearman correlation analysis was performed to identify associations between PUs and tic symptom severity. PUs (PUTS scores) were related to the motor tics (especially the intensity and complexity of motor tics), but not to the vocal tics (Table 2). PUs also showed significant positive correlation with total tic severity, tic-caused impairment and YGTSS total score (Table 2).

PU severity was considered as a predictor of tic symptom severity, and a corresponding linear regression analysis was constructed. The results showed that PUTS score was a significant positive predictor of YGTSS total score (standardized beta coefficient = 0.174, $t = 2.786$, $P = 0.006$). Figure 2 shows the predicted probability plot for the linear regression model.

DISCUSSION

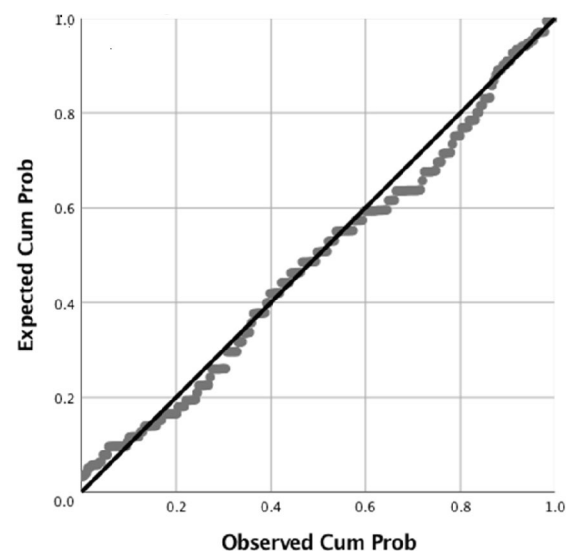
In this study, we found that the mean age, the occurrence rate of PU, the mean score of PUTS and YGTSS were lower comparing to most of previous reports.^{6,7,9,11-13} These are

important clinical characteristics of our sample, indicating the relative younger population and milder symptoms.

TABLE 2 Correlation between tic symptom severity with premonitory urges in the population with tic disorders

Tic symptoms	<i>R</i>	<i>P</i>
Motor tics	0.144	0.022*
Number	0.103	0.104
Frequency	0.091	0.150
Intensity	0.136	0.031*
Complexity	0.140	0.026*
Interference	0.066	0.299
Vocal tics	0.081	0.202
Number	0.067	0.292
Frequency	0.051	0.424
Intensity	0.071	0.258
Complexity	0.111	0.078
Interference	0.090	0.154
YGTSS total score	0.203	0.001*
Total tic severity	0.128	0.043*
Impairment	0.163	0.009*

*indicates statistically significant. *R*, coefficient of correlation. YGTSS, Yale Global Tic Severity Scale.

**FIGURE 2** The predicted probability plot for the linear regression model.

We explore the association between PUs and tic symptoms. The severity of PUs demonstrates a positive correlation with tic severity and tic-caused impairment. It also shows that PUs could significantly predict tic symptom severity. Indeed, it has been reported that PUs represent a preprocessing stage of tic expression.²³ Therefore, because of the important association of PUs and tics, we recommend that PU assessment should be included in most studies about tic disorders. However, the assessment of PUs seems to be neglected. For example, most randomized controlled trials on TS treatments do not report changes in PUs.^{24,25} The PUs may represent the initial process by which tic symptoms develop, and should receive more attention.

Previous studies about PUs were mainly conducted on individuals older than 8 years.^{6,7,9,11,13} Recently some studies applied PUTS on younger children.^{12,14,26} In our experience, with the help of psychiatrists, half of the children aged 5 years and most of the children aged between 6–7 years could report PUs reliably; but none of the children younger than 5 years can understand the PUTS items. For this reason, we only included participants older than 5 years. However, a more suitable tool to assess PUs in younger children is needed.

Few studies in China have focused on the location of tic symptoms. Here, we report the most frequent tic symptom locations. Our previous report of two cases of PU locations on the tongue⁸ indicated that, owing to the lack of information about PU and tic symptom locations, some cases may be easily misdiagnosed, especially by pediatricians. Therefore, location information for PUs and tic symptoms should be included in future assessments.

There are three limitations to this study. First, the sample size was relatively small and only children were included. A larger sample comprising both children and adults is needed to better explore the relationship between PUs and tic symptoms. Second, our sample is mainly comprised of individuals with mild to moderate tic symptoms. Including more severe cases will be better. Third, we did not assess the effects of comorbid conditions on PUs and tics. A more detailed history taking and further assessment on intelligence quotient, attention deficient/hyperactivity disorder, obsessive compulsive disorder, anxiety disorders and other mental disorders should be conducted in future research.

In conclusion, we provide evidence for a correlation between PUs and tic symptoms. PU severity predicts the severity of tic symptoms. More research is needed on PUs that includes assessment (e.g. validated tools for younger children and assessment of PU location), shared brain mechanisms with tic symptoms, and the role of PU in tic expression. Greater insight into the pathophysiology of PUs could lead to the future identification of new therapeutic

modalities targeting the sensory initiators of tics.

CONFLICT OF INTEREST

None.

REFERENCES

1. Cravedi E, Deniau E, Giannitelli M, Xavier J, Hartmann A, Cohen D. Tourette syndrome and other neurodevelopmental disorders: A comprehensive review. *Child Adolesc Psychiatry Ment Health*. 2017;11:59.
2. Yang C, Zhang L, Zhu P, Zhu C, Guo Q. The prevalence of tic disorders for children in China: A systematic review and meta-analysis. *Medicine (Baltimore)*. 2016;95:e4354.
3. Kwak C, Dat Vuong K, Jankovic J. Premonitory sensory phenomenon in Tourette's syndrome. *Mov Disord*. 2003;18:1530-1533.
4. Rajagopal S, Seri, Cavanna AE. Premonitory urges and sensorimotor processing in Tourette syndrome. *Behav Neurol*. 2013;27:65-73.
5. Sutherland Owens AN, Miguel EC, Swerdlow NR. Sensory gating scales and premonitory urges in Tourette syndrome. *ScientificWorldJournal*. 2011;11:736-741.
6. Reese HE, Scahill L, Peterson AL, Crowe K, Woods DW, Piacentini J, et al. The premonitory urge to tic: Measurement, characteristics, and correlates in older adolescents and adults. *Behav Ther*. 2014;45:177-186.
7. Crossley E, Cavanna AE. Sensory phenomena: Clinical correlates and impact on quality of life in adult patients with Tourette syndrome. *Psychiatry Res*. 2013;209:705-710.
8. Li Y, Zhang JS, Wen F, Lu XY, Yan CM, Wang F, et al. Premonitory urges located in the tongue for tic disorder: Two case reports and review of literature. *World J Clin Cases*. 2019;7:1508-1514.
9. 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.
10. Li Y, Wang F, Liu J, Wen F, Yan C, Zhang J, et al. The correlation between the severity of premonitory urges and tic symptoms: A meta-analysis. *J Child Adolesc Psychopharmacol*. 2019;29:652-658.
11. Rozenman M, Johnson OE, Chang SW, Woods DW, Walkup JT, Wilhelm S, et al. Relationships between premonitory urge and anxiety in youth with chronic tic disorders. *Child Health Care*. 2015;44:235-248.
12. Kyriazi M, Kalyva E, Vargiami E, Krikonis K, Zafeiriou D. Premonitory urges and their link with tic severity in children and adolescents with tic disorders. *Front Psychiatry*. 2019;10:569.
13. Kano Y, Matsuda N, Nonaka M, Fujio M, Kuwabara H, Kono T. Sensory phenomena related to tics, obsessive-compulsive symptoms, and global functioning in Tourette syndrome. *Compr Psychiatry*. 2015;62:141-146.
14. Gulisano M, Cali P, Palermo F, Robertson M, Rizzo R. Premonitory urges in patients with Gilles de la Tourette

- syndrome: An Italian translation and a 7-year follow-up. *J Child Adolesc Psychopharmacol*. 2015;25:810-816.
15. Steinberg T, Harush A, Barnea M, Dar R, Piacentini J, Woods D, et al. Tic-related cognition, sensory phenomena, and anxiety in children and adolescents with Tourette syndrome. *Compr Psychiatry*. 2013;54:462-466.
 16. McGuire JF. Behavior therapy for youth with Tourette disorder. *J Clin Psychol*. 2016;72:1191-1199.
 17. McGuire JF, Ricketts EJ, Piacentini J, Murphy TK, Storch EA, Lewin AB. Behavior therapy for tic disorders: An evidenced-based review and new directions for treatment research. *Curr Dev Disord Rep*. 2015;2:309-317.
 18. Wile DJ, Pringsheim TM. Behavior therapy for Tourette Syndrome: A systematic review and Meta-analysis. *Curr Treat Options Neurol*. 2013;15:385-395.
 19. Draper A, Jackson GM, Morgan PS, Jackson SR. Premonitory urges are associated with decreased grey matter thickness within the insula and sensorimotor cortex in young people with Tourette syndrome. *J Neuropsychol*. 2016;10:143-153.
 20. Cavanna AE, Black KJ, Hallett M, Voon V. Neurobiology of the premonitory urge in Tourette syndrome: Pathophysiology and treatment Implications. *J Neuropsychiatry Clin Neurosci*. 2017;29:95-104.
 21. Conceicao VA, Dias A, Farinha AC, Maia TV. Premonitory urges and tics in Tourette syndrome: Computational mechanisms and neural correlates. *Curr Opin Neurobiol*. 2017;46:187-199.
 22. Storch EA, Murphy TK, Geffken GR, Sajid M, Allen P, Roberti JW, et al. Reliability and validity of the Yale Global Tic Severity Scale. *Psychol Assess*. 2005;17:486-491.
 23. Brandt VC, Beck C, Sajin V, Baaske MK, Baumer T, Beste C, et al. Temporal relationship between premonitory urges and tics in Gilles de la Tourette syndrome. *Cortex*. 2016;77:24-37.
 24. Welter ML, Houeto JL, Worbe Y, Diallo MH, Hartmann A, Tezenas du Montcel S, et al. Long-term effects of anterior pallidal deep brain stimulation for Tourette's syndrome. *Mov Disord*. 2019;34:586-588.
 25. Dyke K, Jackson GM, Nixon E, Jackson SR. Effects of single-session cathodal transcranial direct current stimulation on tic symptoms in Tourette's syndrome. *Exp Brain Res*. 2019;237:2853-2863.
 26. Openneer TJC, Tarnok Z, Bognar E, Benaroya-Milshtein N, Garcia-Delgar B, Morer A, et al. The premonitory urge for tics scale in a large sample of children and adolescents: Psychometric properties in a developmental context. An EMTICS study. *Eur Child Adolesc Psychiatry*. 2019;doi:10.1007/s00787-019-01450-1.

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