



Tic Reduction Following Heat-Induced Dehydration in Gilles de la Tourette Syndrome (TS) [†]

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Abstract: A 24-year-old man with of Gilles de la Tourette (TS) syndrome experienced a marked remission of 2 years after heat-induced dehydration. Further investigation of the effects of heat and dehydration on TS may be useful.

Keywords: adverse effects; beneficial effects; cannabis; clinical trial; dopamine; emesis; movement disorder; neurotransmitter; obsessive compulsive disorder; rating scales



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1. Introduction

Gilles de la Tourette Syndrome (TS)-related tics are challenging to eliminate. Heat has, in some cases, reduced symptoms in TS. However, prior reports have produced opposing results [1]. Individuals with tics and other manifestations of TS typically experience a decrease in symptoms with dopamine-receptor-blocking drugs, while stimulants cause an exacerbation of symptoms [2,3]. Those who can attain remission likely have a later age of onset as opposed to those who have had an earlier age of onset [4].

The goal of the study is to investigate the role of exposure to increased temperatures on people with TS.

2. Materials and Methods

A 36-year-old man was diagnosed with TS at age 7 because he experienced both motor and phonic tics for more than a year.

When he was 10, he began to exhibit tics with vomiting when he ate meals.

When he was 24, he could not work carrying fragile items because he would likely have tics leading to breakage. His subjective ratings (Table 1) document the severity of his impairments. He thought that the effect of dopamine could be altered by extreme heat to eliminate his tics. He did not seek or obtain the approval of his providers to undertake prolonged exposure to markedly high temperatures. He deliberately submerged himself in water at 39.4° Celsius to 40° Celsius for up to four hours with the goal to become dehydrated. Tics stopped after remaining in the hot water for two hours. The tics then were markedly reduced for a couple of years, as documented by objective ratings (Table 2).

Table 1. Subjective measurements of a 24-year-old man before entering a hot tub.

Instrument	Range of Scores	Seven Months before Remission
Compulsion checklist [5]	(0,111)	10
Dental pain/fear/anxiety [5]	(0,112)	4
Dental pain/fear/anxiety Mid [5]	(0,112)	4
Dental pain/fear/anxiety Post [5]	(0,112)	1
Dental pain/fear/anxiety 1 month follow-up [5]	(0,112)	0
Dental pain/fear/anxiety 3 months follow-up [5]	(0,112)	0
Fear questionnaire [5]	(0,192)	8
Social situations questionnaire [5]	(0,192)	13
Questionnaire for tic disorders [6]	(0,23)	21
Tic symptom self-report: motor [7]	(0,60)	24
Tic symptom self-report: vocal [7]	(0,60)	11
University of Miami Modified Maudsley Obsessive Compulsive Inventory [8]	(0,60)	11
Wender Utah Rating Scale (WURS) behaviors [9]	(0,168)	46
Wender Utah Rating Scale (WURS) medical problems [9]	(0,28)	1
Wender Utah Rating Scale (WURS) school [9]	(0,48)	11
Wender Utah Rating Scale (WURS) Attention-Deficit/Hyperactivity Disorder (ADHD) items [9]	(0,100)	39

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However, tics resumed markedly worse when he received a tetanus vaccination at age 27. The frequency of the tics then became much reduced.

He experienced a marked reduction in tics with the inhalation of the vapor of a $\Delta 9$ -tetrahydrocannabinol (THC) solution each night.

At age 36, his symptoms are well-controlled with the occasional use of the vapor of a $\Delta 9$ -tetrahydrocannabinol (THC) without other medication.

Table 2. Objective measurements.

Instrument	Range of Scores	Six Months before Remission	One Month after Remission	Eleven Months after Remission
Urine drug toxicology for tetrahydrocannabis	Negative or positive	Negative	Positive	Positive
Abnormal Involuntary Movement Scale (AIMS) [11]	(0,40)	9	0	1
Clinical Global Impression (CGI) Severity Index (SI) [12]	(0,7)	4 Moderately mentally ill	3 Mildly ill	2 Borderline mentally ill
Clinical Global Impression (CGI) Global Improvement (GI) [12]	(0,7)	4 No change	2 Much improved	1 Very much improved
Clinical Global Impression (CGI) Efficacy Index (EI) [12]	(0,16)	13	5	13
Clinical Global Impression (CGI) therapeutic effect [12]	N/A	Unchanged or worse	Moderate	Unchanged or worse

Table 2. Cont.

Instrument	Range of Scores	Six Months before Remission	One Month after Remission	Eleven Months after Remission
Clinical Global Impression (CGI) side effects [12]	N/A	None	None	None
Clinical Global Impression (CGI) Attention Deficit Disorder (ADD) [13]	(0,6)	1 Borderline	0	1 Borderline
Clinical Global Impression (CGI) Obsessive-Compulsive Disorder (OCD) [13]	(0,6)	3 Moderate	2	2 Mild
Clinical Global Impression (CGI) Tourette syndrome (TS) [13]	(0,6)	3 Moderate	1	1 Borderline
Clinical Global Improvement (CGI) Rater Global Evaluation (RGE) [14]	(1,7)	4 Unchanged	2 Much improved	1 Very much improved
Hillside Akathisia Scale (HAS) subjective items [11,15]	(0,8)	0	0	0
Hillside Akathisia Scale (HAS) objective items [11,15]	(0,12)	6	0	0
Hillside Akathisia Scale (HAS) Clinical Global Impression (CGI) Severity of Akathisia (SA) [11,15]	(0,7)	3 Mildly akathisic	1 Normal, not akathisic	1 Normal, not akathisic
Hillside Akathisia Scale (HAS) Clinical Global Impression (CGI) Global Improvement (GI) [11,15]	(0,7)	4 No change	1 Very much improved	1 Very much improved
Magnetic resonance imaging of the brain ([16], Table II, page 346)	Normal or abnormal	Normal	Normal	Normal
Maryland Psychiatric Research Center (MPRC) Brief Psychiatric Rating Scale (BPRS) anchors [17–19]	(20,140)	26	21	21
Movement disorders checklist [11]	(0,23)	14	8	0
Myoclonus versus tic checklist [11,20]	(−2,6)	6	3	0
National Institutes of Mental Health (NIMH) Obsessive Compulsive Scale (OCS) [14]	(0,15)	5	2	1
Rating Scale for Acute Drug-Induced Akathisia (RSADIA): subjective [21]	(0,9)	0	0	0
Rating Scale for Acute Drug-Induced Akathisia (RSADIA): objective [21]	(0,21)	1	0	0
Rating Scale for Acute Drug-Induced Akathisia (RSADIA): global rating [21]	(0,3)	0	0	0
Rating Scale for Drug-Induced Akathisia (RSDIA): subjective [22]	(0,6)	0	0	0
Rating Scale for Drug-Induced Akathisia (RSDIA): objective [22]	(0,3)	1	0	0
Rating Scale for Drug-Induced Akathisia (RSDIA) Global Clinical Assessment of Akathisia (GCAA) [22]	(0,5)	1	0	0
Rating Scale for Tardive Dyskinesia (RSTD): face [23]	(16,96)	26	17	18

Table 2. *Cont.*

Instrument	Range of Scores	Six Months before Remission	One Month after Remission	Eleven Months after Remission
Rating Scale for Tardive Dyskinesia (RSTD): neck and trunk [23]	(8,48)	11	8	8
Rating Scale for Tardive Dyskinesia (RSTD): extremities (upper) [23]	(8,48)	11	8	8
Rating Scale for Tardive Dyskinesia (RSTD): extremities (lower) [23]	(8,48)	8	8	8
Rating Scale for Tardive Dyskinesia (RSTD): entire body [23]	(4,24)	4	4	4
Timed stereotypies rating scale [11,24]	(0,1000)	27	2	1
Tourette Syndrome Diagnostic Confidence Index (TSDCI) [25]	(0,100)	61	Missing	82
Yale-Brown Obsessive Compulsive Scale (Y-BOCS) [26,27]	(0,40)	4	10	4
Obsessive compulsive disorder through the application of the criteria current at the time of the study [28] to the Yale–Brown Obsessive Compulsive Scale (Y-BOCS) [26,27] ^a	(0,1)	0	1	0
Yale Global Tic Severity Scale (YGTSS): motor [29]	(0,25)	19	13	12
Yale Global Tic Severity Scale (YGTSS): phonic [29]	(0,25)	9	0	11
Yale Global Tic Severity Scale (YGTSS): impairment [29]	(0,50)	27	0	9

N/A: Not Applicable. ^a Obsessive Compulsive Disorder (OCD) is diagnosed according to the *Diagnostic and statistical manual of mental disorders*, (4th ed.), text revision (DSM-IV-TR™) [28] if on the Y-BOCS [26,27] a person scores 2, 3, or 4 on any of the following items: time spent on obsessions, interference from obsessions, distress of obsessions, time spent on compulsions, interference from compulsions, and distress of compulsions [4,10,30]. Reprinted/adapted with permission from Ref. [10], 2015, Frontiers SA.

3. Results and Discussion

3.1. Six Months before Entering a Hot Tub

As a 24-year-old man, the participant had difficulty working as he feared he would drop glass bottles due to his tics (Table 1, Video S1).

3.2. One Month after Entering Hot Tub

After entering the hot tub, the patient had a marked remission from tics (Table 2, Video S2).

3.3. Subsequent Course

The remission after dehydration continued for 2 years until he received a tetanus immunization that led to the worst-ever exacerbation of tics.

He currently continues to function with tics controlled through the use of vaporized THC every night.

3.4. Discussion

A 36-year-old man with TS, experienced a two-year remission at 24 years of age after profound heat-induced dehydration. This remission ended after he received a tetanus immunization, which resulted in the worst exacerbation of his tics. He has controlled his tics with the use of vaporized THC every night. He continues to hold several jobs, working approximately 70 h per week.

It is important to note that heat-induced dehydration can have severe consequences. It can lead to fatality and other health-related problems when induced without medical supervision.

The regular use of the vaporized THC may be beneficial to control symptoms and signs of TS [31–40].

3.4.1. Limitations

There are limitations of this case report. Because it is a single case, the findings cannot be applied to any general population.

As the symptoms and signs of TS routinely fluctuate, this patient's remission may represent a natural course of the disease and not an effect of the heat-induced dehydration.

Additionally, there may be beneficial effects of aging for people with TS. The patient may be demonstrating a decreased presentation of signs and symptoms because of attaining maturity.

3.4.2. Future Directions

The literature about the effect of heat on TS is conflicting. The results of treatment of TS through heat-induced dehydration are uncertain.

Controlled clinical trials of the effects of heat and dehydration are merited to investigate the possible beneficial effects of this intervention.

There is evidence that CB₁ receptor binding, a common association with the presence of tics and other symptoms of TS, is greatly reduced after THC treatment [31–40].

Additionally, there is indication that cannabis medicine could be beneficial to the treatment of TS, especially with the approach of starting with low dosages and increasing over time [31–40].

There exists a radiotracer available that has been effective for schizophrenia, which might be useful for future directions in Tourette research. An investigation of people with TS with and without the use of THC could be beneficial [31–40].

We hypothesize that patients with TS also experience down-regulation of cannabinoid receptor subtype 1 (CB₁) with regular use of THC. Clinical trials to investigate the effect of THC agents on CB₁ receptors on people with TS are needed.

4. Conclusions

The regular use of THC and other cannabis derivatives may be beneficial for the control of tics related to TS [31–40].

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/IECBS2022-13505/s1>, Video S1: A 24-year-old man was asked to stand still for 2 min; Video S2: A 25-year-old man was asked to stand still for 2 min.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: All data are provided in the tables and videos.

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Conflicts of Interest: The authors declare no conflict of interest.

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