

Abbreviations

TS: Tourette Syndrome, ADHD: Attention deficit hyperactivity disorder, OCD: obsessive compulsive disorder

ABSTRACT

Introduction:

TS is a neurodevelopmental disorder starting before the age of 18 years characterised by the presence of at least one vocal and multiple motor tics lasting for a year and not explained by medications or another medical condition. TS is thought to occur due to striatal dysfunction in the brain subsequently affecting the frontostriatal pathways (6) possibly leading to disinhibition and executive function deficits (1).

Method

Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist was followed to analyse 4 studies from 2014 - 2019.

Results:

While some studies show no difference in cognitive functioning in patients with TS others show some associated decline. The discrepancies seem to be associated with methodological differences such as sample size and varied neuropsychological assessment tools used to explore various cognitive sub processes.

Conclusion:

Cognitive deficits in TS is still a less understood topic that will need further research using larger samples and valid neuropsychological assessment tools. Neuroimaging studies to compound the neuropsychological testing can yield more conclusive results.

BACKGROUND

The neurological basis of TS is not clearly understood. It is generally agreed that a wider dysfunction in basal ganglia, frontostriatal circuitry and cortical-striatal-thalamic-cortical (CSTC) circuitry can lead to this disorder (2)(5). Thereby prompting the exploration of cognitive deficits in TS (2).

Tic regulation and control are extensively related to cognitive processes, which are part of the Executive Function system. Executive function is a complex cognitive processing mechanism that requires co-ordination of several sub processes to achieve a certain goal (5).

Executive function includes abilities of goal formation, planning, set shifting, response inhibition, carrying out goal directed plans, and effective performance (5).

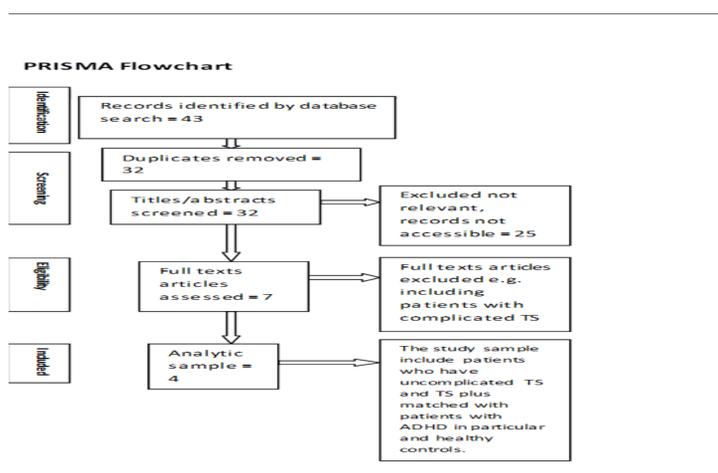
A wide majority (88%) of children with TS have comorbidities that can contribute in adversely affecting cognitive and behavioural outcomes of TS. ADHD is the most commonly associated comorbid disorder - 60% (4) and OCD 28% - 63% (2).

AIM

The aim of the study is to evaluate recent evidence regarding cognitive deficits in people with Tourette Syndrome.

METHOD

The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist. Two databases PsychINFO and EMBASE from 2014 – present (last 5 years) were used for a comprehensive search strategy using Cheshire and Wirral NHS Foundation Trust Healthcare and Management Databases. The key words were '(Tourette*)' OR '(TS*)' OR '(TS)' AND '(cognitive*)' AND '(deficit*)' OR '(disorder*)' OR '(function*)'. Records were limited to those in English language.



DISCUSSION

Studies showed disparity in results due to differences in sample sizes, ages of the participants, co-morbidities and varied psychological assessment tools that explored different cognitive sub processes.

The studies considered the prevalence of other co-morbid conditions like ADHD, OCD and impulse control disorders and tried to minimise their confounding effects via their adopted methodology and statistical analysis. Nonetheless, the symptoms were highly inter-correlated and their cumulative effect on the results could not be entirely refuted (1).

The severity of tics in individuals was associated with impairment of response inhibition and attentional set shifting in particular. However, it remained unclear if this was a ramification of TS implicated by functional impairment or associated symptoms videlicet tic suppression or release (2).

Broader cognitive functioning was intact in TS. Deficits were noted in specific cognitive domains linked with attention, processing speed and working memory (2).

RESULTS

Study	participants	Clinical measures	Executive functioning measures	Results
Openneer et al 2019 Netherlands	174 participants 8 – 12 years old *n = 34 TS – ADHD *n = 26 TS + ADHD *n = 54 ADHD - TS *n = 60 healthy controls	*YGSS *CY-BOCS * K-SADS and DSM-IV-TR criteria for mood, ODD and CD *CPRS-RL for ADHD severity *IQ estimation - WISC-III	Measure of psychomotor speed and a range of executive functions i.e. attentional flexibility, response inhibition, cognitive control and working memory).	TS-ADHD longer visuo-motor reaction time than other groups. No group differences were found in response inhibition and attentional flexibility. TS+ADHD most errors on cognitive control task Higher ADHD severity was associated with poor cognitive control and working memory across all groups. OCD severity or medication use did not influence the results.
Clare M. Eddy and Andrea E. Cavanna 2017 UK	52 participants 17-69 years of age *n = 27 Uncomplicated TS *n = 25 Healthy controls *n = 10	*YGSS for tics severity *PUTS (premonitory urge for tics scale) *OCI-R *ASRS *HADS *MIDI	IQ subsets *Verbal fluency *Digit ordering Test-adopted (DOT-A) *Stroop test *Hayling Test *Trail making test (TMT) *Wisconsin card sorting test (WCST) *Digit symbol substitution test (DSST) *WAIS Test	Broader cognitive functioning is intact in TS. Deficits were noted in specific cognitive domains linked with attention, processing speed and working memory.
Takacs et al. 2017 Israel	*78 participants 7-17 years of age *n 13 – TS *20 – ADHD *22 – ADHD-TS *21 typically developing children	DSM-IV criteria to diagnose TS and ADHD Psychometric tools not mentioned in the study. Major psychiatric or neurological conditions were excluded. OCD and ODD were not excluded due to high co-morbidity with TS.	Probabilistic sequence learning was examined with the alternating serial reaction time (ASRT) task.	In both TS and ADHD, as well as in comorbid TS-ADHD, learning sequences in procedural memory may remain intact. While certain other forms of learning (e.g., non-sequential categorization) in this system may be impaired.
Yaniv et al. 2016 Israel	*40 participants *20 healthy controls *20 with TS 2 – TS + ADHD 4 – TS + OCD 5 – TS + ADHD + OCD	YGSS Clinical interviews and family history to exclude major neurological and psychiatric disorders	ECST WAIS-iv SST, TST, Wechsler block design	Response inhibition is the principal impaired component and that the magnitude of this impairment affects the severity of tics in TS patients.

CONCLUSION

- The relationship between TS and cognitive deficits is complex and an area still to be cognized with.
- While some studies show no difference in cognitive functioning in patients with TS others show some associated decline and in one study evaluated for this article even an enhancement of the procedural learning was discussed (3).
- An interesting aspect was the notion where TS with and without comorbid ADHD were represented as two distinct types, because possible deficits in executive functioning were primarily explained by comorbid ADHD and not inherently associated with TS (1)
- Neuroimaging studies to compound the neuropsychological testing can yield more conclusive results.

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