The irrepresible manifestation of one symptom of the movement disorder Tourette syndrome (TS) — tics — can be disruptive to every day living for people with the disorder. Tics are brief actions that a person feels compelled to perform repeatedly. They can be simple involving brief, purposeless acts such as eye blinking, facial grimacing, or head, limb, and trunk jerks or they can be complex involving extended actions that appear to have a purpose such as scratching. Tics can also be vocal involving outbursts of grunting, echolalia (repetition of another person's words), and coprolalia (swearing) or other socially offensive language.

Tics can result in sleep difficulties by delaying the onset of sleep or by causing arousals during sleep. But in addition to tics, TS affects sleep in other ways as various polysomnographic studies reveal.

David G. Glaze et al. used polysomnography to compare the sleep of unmedicated TS subjects with the sleep of TS subjects who had previously been treated with the tranquilizer haloperidol. (The latter group was not using the drug at the time of the study). They found that, in comparison to healthy control subjects, both groups had increased amounts of slow wave sleep and decreased amounts of rapid eye movement sleep. Since brainstem serotonergic pathways play a role in the maintenance of slow wave sleep and dopaminergic pathways are involved in the maintenance of REM sleep, Glaze et al. believe that the changes in slow wave sleep and REM sleep suggest that serotonergic and dopaminergic pathways are affected in TS.

Glaze et al. also noted that a little more than one half of the unmedicated subjects had episodes during slow wave sleep that were reminiscent of pavor nocturnus. These subjects would awaken suddenly, disoriented, confused, and/or combative. Tics were increased during the episodes and at times the subjects would have automatic behavior. They believe that the increased incidence of pavor-like episodes indicates that sleep problems in people with TS may result from an arousal disorder.

Silvestri et al. similarly found reduced amounts of REM sleep and increased amounts of slow wave sleep in their polysomnographic study of nine TS subjects. In addition to noting these sleep stage changes, they were especially interested in finding out if phasic sleep features (spindling, eye movements) differed in people with TS and without TS (controls). Scientists have noted that impaired thalamic firing appears to play a role in increased spindling as well as in dyskinetic movements in TS and other neurological disorders (e.g., Huntington's chorea, stroke, multiple sclerosis). Therefore Silvestri et al. expected to find a correlation between symptom severity and spindling — the more severe the TS, the more excessive the spindling.

When they counted the subjects’ spindling rate during stage 2 sleep, they found that the young TS subjects (age range 11-15 years old) overall had a reduced rate of spindling during stage 2 sleep and less severe TS symptoms during wake. But in keeping with their expectations, two of the adult subjects who had the most severe symptoms during wake also had the highest rate of spindling during stage 2 sleep.

From these results, Silvestri et al. propose that excessive spindling (and therefore severe TS symptoms) may not be possible in the less mature brain of the young subjects. The subjects’ histories add credence to this. The histories revealed a progression in symptom severity: early manifestations of TS involved simple rapid limb, head, trunk movements; vocal tics occurred a few years later after the onset of symptoms; and subjects with longer duration of TS had more severe, violent, and complex tics.

Periodic limb movement (PLM) disorder may be another factor that interferes with sleep in people with TS. Various studies show a high prevalence of PLM disorder in people with TS. For example, Ulrich Vorderholzer et al. found that five of their seven subjects had periodic limb movements. On examining to what extent PLMs were associated with arousals, they found that the majority of limb movements did not cause an arousal.

Nevertheless, the increased limb movements may be significant. Both PLMs and TS involve repetitive involuntary movements and therefore may share some physiological commonalities. One commonality of the two disorders appears to be the involvement of the dopaminergic nervous system: dopamine agonists (e.g., clonazepam) can reduce PLMs while dopamine antagonists (e.g., haloperidol) can reduce tics.

Some researchers suspect the cholinergic system is involved the sleep problems of people with TS. Cohrs et al. investigated this possibility by examining the influence of REM and non-REM sleep on tic and non-tic movement during sleep. Since the cholinergic system plays a role in wake and is activated during an arousal, they postulated that tics during arousals from sleep would suggest activation of the cholinergic system in TS.

Cohrs et al. found that TS subjects had increased amounts of both tic and non-tic movements during sleep compared to non-TS controls. In the TS group, the amount of increased movement (both tic and non-tic) was equal in REM and non-REM sleep; the intensity of tics — rated on a scale of 0.5 (mild) to 8 (severe) — remained mild in all subjects during sleep; the complexity of tics remained simple in both REM and nonREM sleep; and tics were less often followed by arousal compared to non-tic movements. Because tic manifestation (i.e., quantity, complexity, and intensity) was not dramatically different between REM and non-REM sleep and because tics were not followed by arousals, Cohrs et al. concluded that an impaired cholinergic system was not behind TS sleep problems.

Many sleep studies with TS subjects have made conclusions based on the combined results of children, adolescents, and adult subjects. For continued on page 10
example, the Glaze study based results on 8-48 year old subjects and the Silvestri study based its results on 11-32 year old subjects. Since sleep features differ from childhood to old age, some of the results such as sleep stage percentages may be skewed. Recognizing this experimental flaw, scientists have recently begun to study each age group independently. For example, Tatiana Kostanecka-Endress et al. in a 2003 study focused on the sleep of unmedicated children with TS to get a clearer idea of how TS affects sleep from the outset. They found that the TS children had increased latencies to each sleep stage, an increased amount of wake after sleep onset, decreased amount of stage 2 sleep, and normal amounts of both REM sleep and slow wave sleep. This last finding conflicts with other researchers whose studies show a decreased amount of REM sleep and an increased amount of slow wave sleep or other alterations in these stages. Kostanecka-Endress et al. cite the Voderholzer and Cohrs studies (mentioned above) which similarly found normal amounts of REM sleep in their TS subjects. Both the Voderholzer and Cohrs studies used adult subjects whose average age was 31 years and 29 years, respectively.

Scientists are developing new ways to view TS as a result of polysomnographic study. Sleep stage changes (e.g., increased slow wave sleep) has caused some scientists to view TS in terms of impaired dopaminergic, serotonergic, or cholinergic brainstem pathways; the high prevalence of limb movements in sleep has caused some scientists to view TS in terms of hyperarousal; and differing results for children and adults has caused some scientists to view TS in terms of brain maturation (some scientists believe that the development of a TS child’s brain may be delayed). More tests are needed — especially studies that focus on specific age groups. Knowing the typical sleep problems in each age group could then allow for more precise treatment of the sleep disorders in people with TS. Improved sleep, in turn, would have a beneficial effect on TS symptoms.

Notes

References