

Tics, Myoclonus, Other Movement Disorders

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GILLES DE LA TOURETTE SYNDROME

Primary tic disorder - no specific morphologic changes in brain.

- 1) **Gilles de la Tourette syndrome (GTS)** - motor AND vocal tics for > 1 year.
- 2) **chronic tic disorder** - motor OR vocal tics (but not both!) for > 1 year.
- 3) **transient tic disorder (TTD) of childhood** - motor OR vocal tics with duration < 1 year.
 - occurs in as many as 24% of school children.

PATHOPHYSIOLOGY

- 1) developmental striatal **DOPAMINERGIC hyperfunction** (terminal hyperinnervation and receptor supersensitivity) - tics respond to antidopaminergics!
- 2) **SEROTONERGIC dysfunction** - obsessive-compulsive disorder (related to serotonergic neurochemistry) is present in 50% patients.

N.B. tics are not mediated through normal motor pathways used for willed movements!

EPIDEMIOLOGY

- **relatively common neurological disorder** (once considered rare* psychiatric condition) - PREVALENCE 0.03-0.05% adolescents (up to 1-3% in boys).
*because most children have mild and undiagnosed symptoms.
- boys >> girls (1.6-10 : 1)
- **AUTOSOMAL DOMINANT** disorder with variable sex-specific penetrance (approaches 100% in boys) - in 60% cases, family history can be found (no genetic marker, however, has yet been identified - pattern of inheritance may be more complicated than previously was thought*): simple transient tic of childhood ÷ GTS
*e.g. result of chance *convergence of multiple genetic defects* inherited from maternal and paternal sides (**BILINEAL TRANSMISSION**).
- **high-risk population** - *children with special education needs* (GTS prevalence here ≈ 12%).
- perinatal complications also increase risk.
- incidence of left-handedness or ambidexterity is greater than among normal persons.

CLINICAL MANIFESTATIONS

Multifocal **motor** + one or more **vocal tics** lasting > 1 year with no asymptomatic period of > 3 months

ONSET

about tics see p. Mov1 >>

GTS is disorder with childhood onset (**upper age limit** for symptom development is 14 years in DSM-III; 21 years in DSM-III-R; and **18 years** in DSM-IV).

- mean age at onset is 6-7 years; 75% patients have symptoms by age 11 years.
- tics may present **suddenly**; however, they usually become noticeable **gradually** or have intervening spontaneous remissions.
- most common presenting symptoms - **simple tics**:
 - a) **motor tics** (80%): *facial tics* (50-70%) > neck or shoulder tics > tics of upper extremities > tics of lower extremities and trunk.
 - b) **vocal tics** (20%) occur as initial symptoms in only 12-37% patients (generally noises rather than words).
 - vocalizations may simply consist of motor tics that affect vocal apparatus.
 - utterance of actual words is virtually pathognomonic of GTS but is very rare as presenting symptom.

N.B. coprolalia and other socially unacceptable phenomena (copropraxia, coprographia) are not necessary to diagnosis of GTS! e.g. coprolalia occurs in 20-50% patients

FURTHER COURSE

- symptoms reach fullest expression ≈ decade after onset.
- **chronic waxing and waning** - anatomic location, number, frequency, complexity, type, and severity change over time!
- **complex tics** (e.g. skipping, squatting, touching, twirling) *become more common*; vocal tics may change from meaningless sounds to words or phrases.
 - **coprolalia** (most complex type of vocal tic) does not appear until 4-7 years after onset of disorder; coprolalia only occurs in < 1/3 patients (although never experiencing coprolalia, some patients describe intrusive coprolalic thoughts [mental coprolalia] or may even exhibit coprographia).
 - other symptoms may appear:
 - 1) slower more sustained movements (e.g. dystonic tics)
 - 2) self-injurious tics
 - 3) sensory tics
 - 4) copropraxia
 - 5) echolalia, palilalia
 - 6) irregular speech intonations, talking with different accents.
- **various triggers may provoke tics**:
 - exogenous agents (e.g. caffeine, dopaminergic medications and CNS stimulants).
 - endogenous processes (e.g. menstrual cycles, other hormonal changes).
 - excitement (positive or negative) causes worsening of tics - patients avoid **social encounters** (environmental stresses can provoke tics) - children, therefore, often do not do well in school irrespective of their IQ.
- if tics are suppressed voluntarily for time, period of intense tics follows (as if tics were reserved and then released all at once).
- sudden explosive episodes of **uncontrollable rage** have been reported in several patients.
- most patients show **marked improvement after adolescence**:
 - 30% - complete remission!!! (complete life-long remissions are rare)
 - 30% - no clinically significant tics
 - 30% continue to be symptomatic throughout middle age.

Many patients develop **BEHAVIORAL DISORDERS** (may dominate clinical picture)

Problems with attention and learning!

- 1) **obsessive-compulsive disorder** (in 50% patients!); complex motor tics may be difficult to differentiate from compulsions!
compulsions are associated with feeling of anxiety, tension, or other discomfort, which is relieved, at least temporarily, by performance of activity (alternatively such activity may be called "compulsive tics")
- 2) **attention deficit hyperactivity disorder** (in 50% patients!)
- 3) impulsive and self-destructive behavior
- 4) sleep abnormalities (parasomnias, bedwetting, interruption by tics)
- 5) alterations in mood and sexual behavior.

Pure GTS - consists only of motor and vocal tics.

Full-blown GTS - also includes coprophenomena, echophenomena, and paliphenomena.

GTS plus syndromes - when patient also has ADHD or OCD.

DIAGNOSIS

Neurological **observation** + **videotape** taken at home + careful **family history**.

- to make DSM-IV diagnosis, tics must cause distress or social or functional impairment.
- other diagnostic studies are generally not required.

Neuropsychological testing - to identify patient's strengths and weaknesses - to allow patient to reach maximum academic potential.

TREATMENT

Majority do not require **PHARMACOLOGICAL** therapy!

- at some point many patients require short-term drug therapy (targeted to troublesome symptoms):
 - a) **neuroleptics (dopamine receptor blockers)** (effective in 70-80% cases); many clinicians prefer **PIMOZIDE**, **FLUPHENAZINE** and **HALOPERIDOL**; doses are tapered as tics wane; **atypical antipsychotics** also give good results.
 - b) **dopamine depleters (TETRABENAZINE)**.
 - c) **CLONIDINE** (effective in 50%) - reduces noradrenergic activity in locus coeruleus.
 - d) clonazepam, verapamil, nicotine, deprenyl (selegiline), botulinum toxin.

PSYCHOTHERAPY mainly used for GTS associated with OCD.

- individual, group, or family counseling helps in facilitating healthy adaptation to illness.

SURGERY - last resort for severely disabled patients: bimedial **frontal leukotomy**, bilateral anterior **cingulotomy**, bilateral **limbic leukotomy**, coagulation of dorsomedian and intermediate lateral **thalamic nuclei**.

- **DBS of thalamus** (centromedian nucleus - substantia periventricularis - nucleus ventro-oralis internus crosspoint in thalamus) - significant beneficial effect! (but adverse effects on oculomotor function and reduced energy levels)

ESSENTIAL MYOCLONUS

- rare disorder (PREVALENCE unknown).
- **hereditary** (dominant inheritance with variable severity) or **sporadic**.
- unknown ETIOLOGY.

PATHOGENESIS

SUBCORTICAL origin: small lesions in **brain stem** / **basal ganglia** → deafferentation of ipsilateral frontal lobe and contralateral cerebellum.

DIASCHISIS - sudden inhibition of function - acute focal brain disturbance at distance from original injury site, but anatomically connected with it through fiber tracts.

CLINICAL FEATURES

- onset in 1-2nd decade.
- males = females.
- nonprogressive benign course.
- **myoclonic jerks**:
 - brief (50-200 msec)
 - may be generalized, multifocal, segmental, or unilateral.
 - mainly involve neck or upper body.
 - exacerbated by action (particularly writing or outstretching of arms).
 - abate during sleep.
 - **dramatically ameliorated by alcohol** (nearly diagnostic); following alcohol withdrawal, condition becomes worse on rebound.
- absence of other deficits (except dystonia in some patients).

DIAGNOSIS

- **normal** electrophysiological studies (EEG, somatosensory evoked potentials).
- **normal** neuroimaging.
- **normal** blood, cerebrospinal fluid, and tissue biopsies.

TREATMENT

- 1) **benzodiazepines** (particularly **CLONAZEPAM**) are most effective.
- 2) **anticholinergics** (**BENZTROPINE**, **TRIHENXYPHENIDYL**).

PALATAL MYOCLONUS

- a) **idiopathic**
- b) **dysfunctioning network** connecting **red nucleus-dentate nucleus-inferior olivary nucleus (triangle of GUILLAIN and MOLLARET)** → denervation and hypertrophic degeneration of inferior olivary nucleus.

- continuous synchronous 0.3-10 Hz contractions of soft palate; persist during sleep.
- patients may notice only persistent **ear clicks** (repetitive contractions of tensor veli palatini, which open eustachian tubes).
- generally persist throughout life with infrequent remissions.
- **therapy** is unnecessary in most patients; disorder is usually resistant to therapy:
 - 1) 5-HT₂Trp
 - 2) carbamazepine
 - 3) clonazepam
 - 4) tetrabenazine
 - 5) trihexyphenidyl

MYOCLONIC DYSTONIA

- benign **autosomal dominant** disorder.
- onset in 1-2nd decade of life.
- **DYSTONIA + MYOCLONIC** movements.
- no other neurological deficits.
- dramatic response to alcohol combined with benzodiazepines.

STARTLE SYNDROMES (s. HYPEREXPLEXIA)

- pathologically exaggerated normal startle reflexes, i.e. motor responses to unexpected stimuli (auditory, and at times somesthetic or visual):

Normally, to elicit startle response, **ACOUSTIC STIMULUS** must be 100 dB with rise time < 5 msec;

- bilaterally symmetrical response varies: eye blinking ÷ facial grimacing, head flexion with shoulder abduction, elbow flexion, pronation of forearms, fist clenching.
- HABITUATION (decrease in response magnitude) occurs with 4-5 repeated stimuli.
- normal human auditory startle reflex originates in **caudal brain stem**.
- in hyperexplexia, normal startle circuit is under heightened excitability (perhaps of cerebral origin).

1. **Hereditary hyperexplexia** - autosomal dominant (chromosome 5q) mutations in α -1 subunit of inhibitory **GLYCINE receptor**.
 - continuous stiffness and flexor posture when infant is handled; disappear with sleep.
 - infants characteristically flex (rather than extend) their arms with Moro response.
 - apnea & cardiorespiratory arrest can occur (due to chest wall stiffness).
 - increased tone gradually disappears during first several months of life, yet startle response can interfere with walking and may result in falls.
 - severely affected patients have startle attacks throughout life.
2. **Symptomatic hyperexplexia** – in brain stem disorders.
3. **Startle epilepsy** - epileptic seizures triggered by sudden unexpected stimuli preceded by startle (most commonly due to perinatal anoxic encephalopathy).
4. **Culturally based, conditioned behaviors** - “**Jumping Frenchmen of Maine**” (Quebec), **myriachit** (Siberia), **latah** (Indonesia, Malaysia), **Ragin' Cajun** (Louisiana) - violent startle followed by automatic speech (echolalia, echopraxia, coprolalia), aggressive gestures or defensive postures.
5. **Psychogenic startle** (post-traumatic stress disorder, catatonic schizophrenics, newborns with in utero exposure to cocaine) – startle reaction is delayed (measured electrophysiologically).

TREATMENT

Drugs of choice:

- 1) **BENZODIAZEPINES** (esp. **CLONAZEPAM**)
- 2) GABA agonist (**CLONIDINE**).

Other drugs - valproic acid, 5-HT₂Trp, piracetam.

PAROXYSMAL DYSKINESIAS

- sudden onset of transient choreoathetosis, dystonia, or both.

- pathophysiologically - interface between **movement disorders** and **epilepsy** (EEG may reveal epileptic spikes and phase reversals).
- neurologic examination, neuroimaging, neuropathologic studies are normal.

1. **Kinesigenic paroxysmal choreoathetosis** (autosomal dominant or recessive) - brief movements (lasting < 3 minutes) induced by sudden voluntary movements (esp. arising from sitting position); occur up to 100 times day.
 - unilateral or occasionally bilateral.
 - onset typically 8-14 yrs.; tend to diminish during adulthood.
 - respond well to **anticonvulsants** (phenytoin, carbamazepine, phenobarbital).
2. **Nonkinesigenic & exertional paroxysmal dyskinesias** (autosomal dominant disorders) - more dystonic than choreic; more prolonged (lasting up to 4 hours) and less frequent (3-5 per day); precipitated by alcohol, coffee, fatigue, stress, excitement.
 - respond poorly to most medical therapy (some improve with clonazepam).

PAINFUL LEGS - MOVING TOES SYNDROME

- movement disorder with sensory symptoms: **writhing movements of toes*** + **pain in legs****.

*continuous throughout waking hours.

** mildly irritating ÷ excruciatingly severe.

N.B. pain does not have shooting / electric quality like radicular irritation.

N.B. movements are not response to pain!

- **patient feels no relief** in moving and instead tires from fruitless attempts to stop movement.
- usually with **back pain** in context of **prior back injury / surgery**; sometimes follows **herpes zoster**.
- **posterior roots and ganglia** has been suggested to explain syndrome.
- electrophysiological studies are normal.
- no effective treatment; sympathetic blockade, anticonvulsants.

POST-TRAUMATIC MOVEMENT DISORDERS

Etiopathophysiology:

- a) **direct injury** to basal nuclei → **early** movement disorders.
- b) **sprouting, remyelination, ephaptic transmission, inflammatory changes, oxidative reactions, and central synaptic reorganization** in basal nuclei → **delayed** movement disorders.
- cause may be even mild TBI (even without loss of consciousness); incidence after severe TBI ≈ 22% (50% transient, 50% persistent).
 - N.B. in many cases, TBI is not a cause (e.g. patient may not have noticed mild movement disorder that was present before injury).
- movement disorders have been described after PERIPHERAL TRAUMA; mechanism - altered sensory input, leading to central cortical & subcortical reorganization; frequently accompanied by reflex sympathetic dystrophy.
 - Examples: blepharospasm after eyelid surgery; oromandibular dystonia after dental procedures; spasmodic dysphonia after facial injuries; cervical dystonia after neck injuries such as whiplash; foot dystonia after stubbing toe; minor foot and ankle injuries → painful legs and moving toes*

Clinically (all types of involuntary movements can occur!) – most common:

1. Parkinsonism (e.g. after repeated head injury as in boxers)
 - TBI may result in temporary exacerbation of pre-existing Parkinson's disease
2. Dystonia
3. Low-frequency kinetic tremors
4. Myoclonus.

BIBLIOGRAPHY for ch. "Movement disorders, Ataxias" → follow this [LINK >>](#)