UNDERSTANDING

Tremor in the Elderly

Tremor is an important and frequent symptom/sign in older patients requiring a logical approach to diagnosis. The clinician should know the different types of common tremors, key questions to ask, practical office examination skills, specific drug treatments, when to refer the patient for a specialist opinion and the possible role of surgery.

By Joel Hurwitz, MB, FRCPC, FCP

Definition and Characteristics of Tremor
Tremor is defined as a rhythmic, oscillatory type of involuntary movement. When found in the elderly, it needs to be distinguished from:
- Dystonia (sustained involuntary contraction);
- Chorea (rapid, random flowing movements);
- Myoclonus (rapid jerking movements);
- Akathisia (subjective state of motor restlessness usually a consequence of neuroleptic exposure); and
- Tardive dyskinesia (mouth, tongue and chewing movements associated with at least three months of neuroleptic exposure).

Tremor amplitude may be classified as fine, medium or coarse and tremor frequency can be divided into three categories of oscillations per second:
- Slow (3 Hz to 5 Hz);
- Intermediate (5 Hz to 8 Hz); and
- Rapid (9 Hz to 12 Hz).

Categories of Tremor
Attention to two factors is critical for correctly categorizing tremor (see Table 1):
- When is the tremor present (e.g. at rest,
with posture or with action)?

- Which parts of the body are affected (e.g. hands, head, tongue, chin, etc.)?

**Rest Tremor**—This tremor, typical of parkinsonism, has a frequency of 4 Hz to 6 Hz, a coarse amplitude and is classically referred to as the “pill rolling” tremor of the hands. It is best observed when the hands are resting on the patient’s lap, but also is consistently seen during walking. This tremor is characteristically worse with anxiety (ask the patient to subtract sevens serially from 100 or say the months of the year in reverse order) and is usually absent during sleep. Rest tremor occurs less commonly in the chin and the legs.

**Postural Tremor**—The name implies that the tremor is present when the body part is positioned against gravity. This tremor, typical of essential tremor (ET), has a frequency of 5 Hz to 9 Hz and an amplitude that varies with different postures. It may, for example, be mild when hands are held extended in front, but is often most marked when the patient holds a cup close to the mouth.

Head tremor (most frequently seen in ET) is also a postural type tremor.

**Table 1**

<table>
<thead>
<tr>
<th>Classification of Differential Diagnosis of Tremors</th>
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<tr>
<td><strong>Rest Tremor</strong></td>
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<tr>
<td>- Parkinson’s disease.</td>
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<tr>
<td>- Other Parkinsonian syndromes (see Table 2).</td>
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<tr>
<td><strong>Postural Tremor</strong></td>
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<tr>
<td>- Essential tremor.</td>
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<td>- Exaggerated physiological tremor.</td>
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<td>- Stress, anxiety, fatigue i.e., post-exertion.</td>
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<td>- Hypoglycemia, hyperthyroidism.</td>
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<td>- Drugs - bronchodilators (eg. salbutamol and aminophylline) lithium, tricyclic antidepressants, selective serotonin reuptake inhibitors (SSRIs), decongestants (eg. pseudoephedrine and phenylpropanolamine) neuroleptics, amphetamines (eg. methylphenidate), dopamine agonists, valproic acid.</td>
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<td>- substance abuse - chronic alcohol use/withdrawal, excess caffeine, benzodiazepine withdrawal.</td>
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<td><strong>Action Tremor</strong></td>
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<td>- Cerebellar disease eg., multiple sclerosis cerebellar infarcts and tumors, (cerebellar atrophy secondary to ethanol more often associated with a gait ataxia).</td>
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<tr>
<td><strong>Miscellaneous</strong></td>
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<td>- Orthostatic tremor.</td>
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<td>- Psychogenic tremor.</td>
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<td>- Asterixis.</td>
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<td>- Clonus.</td>
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Although ET classically presents in middle age, older persons often develop a late onset or “senile” variant of ET which may be mistaken for a parkinsonian tremor. Although other parkinsonian features are absent in ET, a postural action tremor that is indistinguishable from ET may precede, by several
years, the development of Parkinson’s disease (PD) in some patients. Elderly patients with apparent essential tremor should be closely watched for emergence of symptoms and signs of PD.

**Action Tremor**—This tremor is typical of cerebellar disease and, as the name implies, the tremor is present when the affected body part is moving. The tremor characteristically has a frequency of 3 Hz to 10 Hz and is demonstrated by finger-nose or heel-shin testing. Specific tasks, such as handwriting or pouring water may further bring out an action tremor. Although the usual parkinsonian rest tremor may have a postural component, it is usually absent during action.

**Key Questions to Ask Your Patients Regarding Tremor**

- Ask them to describe those situations where tremor is most evident. For example, essential tremor and other postural tremors are typically worse when trying to drink from a glass or spoon, or when carrying a cup. Conversely, alcohol usually ameliorates this type of tremor.
- Enquire regarding other neurological symptoms such as slowing of gait, difficulty with fine motor functions (like doing shirt buttons) or changes in handwriting (micrographia). These are all features of PD.
- Obtain a thorough medication history, including both prescribed and over-the-counter preparations. Always ask about caffeine, alcohol and other lifestyle substances.
- Ask about family history—although ET occurs sporadically it is often inherited. There is a positive family history in at least 50% of all cases and the genetic transmission seems to be autosomal dominant with variable penetrance. Conversely, PD usually occurs sporadically, although persons with a first-degree relative (mother, father, brother, sister or child) with PD are at three times greater risk for the disease.
- Ask how alcohol affects the tremor. About 50% of patients with ET notice improvement after consuming alcohol. Cerebellar tremor typically worsens. Alcohol abuse and withdrawal also may cause tremor.
Key Physical Examination Points Regarding Tremor

- Take a hand-writing sample. (See Figures 1 and 2)
  - Patients with PD have micrographia (script becomes progressively smaller and falls below the line).
- Patients with ET have shaky but normal sized script.
- Look for goiter and signs of hyperthyroidism.
- Do an emotional examination.

Figure 1. This patient has severe essential tremor with significant voice and limb involvement. The figure contains script that reads “This is a sample of my best handwriting” and, on the right side, the patient’s attempt to copy the assessor’s swirl.

Figure 2. This patient has PD. October 1999 is before treatment with levodopa was started and February 2000 is after levodopa treatment. Both swirls on the right hand side are small and characteristic of PD. Hand-writing samples show micrographia but the second, post-treatment sample is somewhat improved.
Remember that agitation is a common presentation of an underlying depression in the older patient and may also be an early manifestation of dementia.

- Look for head tremor. This occurs in ET, cerebellar disease (tremor) but not in PD.
- Look for jaw tremor. This is seen in PD but not ET.
- Look for tongue tremor. A coarse tremor, seen when the tongue protrudes half way out of the mouth, is a feature of PD.
- Examine the patient’s speech.
  - Wavering/quivering is consistent with ET.
  - Hypophonia (a low intensity monotone) is consistent with PD.
  - Scanning dysarthria occurs in cerebellar disease.
- Check for hand and limb tremors (see above).

**Investigations**
Tremor is largely a clinical diagnosis. Hyperthyroidism can be ruled out with thyroid function tests. Cerebellar signs should prompt using either magnetic resonance imaging (MRI) or a computed tomography (CT) scan with posterior fossa views.

**Challenge Test**—PD is a clinical diagnosis and is generally further assessed by the patient’s response to drug treatment. However, the levodopa test in PD (could be considered a form of investigation) was designed to assess whether a single levodopa challenge could predict
dopa responsiveness in patients with PD. Motor function was assessed by:
• The tap test (number of taps on two plates 20 cm apart over 15 seconds); and
• The timed up-and-go (TUG) test. How long does it take to walk 3 m, turn and return?

In the study, patients fasted overnight and had baseline observations of tapping and walking before receiving a test dose of levodopa 100 mg and carbidopa 25 mg, with domperidone 20 mg to prevent nausea and vomiting. Observations were repeated half-hourly over a three-hour period. A positive response was defined as a 20% improvement in either tapping or walking. Non-responders had the test repeated the following day with a double dose (i.e. levodopa 200 mg and carbidopa 50 mg plus domperidone). Patients in this study were elderly (age ranged from 65 to 92 years). A positive test correctly predicted 94% of those patients who responded subsequently to carbidopa given for the following month. Although this test is usually completed by a physiotherapist or nurse clinician, perhaps a modified form of this test is practical within an out-patient/office setting. For example, a baseline tap and walking test, repeated after two to four weeks on treatment. Again, a 20% improvement would be considered positive.

**Treatment of Tremor: Basic Principles**
First, remove any causative factors. Decrease dose or discontinue offending drugs such as decongestants, salbutamol, etc. Those with exaggerated physiological tremor should be encouraged to decrease
TREMOR IN THE ELDERLY

Educate patients, wherever possible, regarding the cause of their tremor and involve them in mutual treatment decision-making. Try to improve general physical and emotional health by treating anemia, depression, etc. Involve physiotherapists and/or occupational therapists as appropriate for the provision of exercise programs, daily living aides and the like. Patients with unusual or severe symptoms should be referred to a neurologist, geriatrician, regional movement disorder clinic or other appropriate specialist.

### Drug Treatment of Specific Tremor Disorders

**Parkinsonian tremor**—The classic features of parkinsonism are:
- T-tremor
- R-rigidity
- A-akinesia
- P-postural instability

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<td>• Anti-emetics (eg. Metoclopramide, Prochlorperazine); and</td>
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<td>• Older antihypertensives (eg. reserpine, alpha-methyldopa).</td>
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Drug-induced Parkinsonism (DIP) is probably the most common form of secondary parkinsonism in the elderly. It may occur in 10-20% of patients receiving neuroleptics, and the mechanism is the blockade of brain dopamine receptors. The most susceptible group for DIP are older women with underlying cognitive deficits. Interestingly, parkinsonian symptoms and signs can take up to six months to clear (and sometimes never clear). Although claims of a low incidence of EPS side effects were made with the release of the newer “atypical” neuroleptics, parkinsonism can still occur with risperidone and olanzapine.

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**Table 3**

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<th>DRUG INDUCED PARKINSONISM (DIP)</th>
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In the elderly, however, tremor is often absent or may be less important to treat when compared to gait slowing, imbalance and falls.

The anticholinergics (e.g. trihexyphenidyl, benztpine mesylate) which are effective for tremor in younger patients, are usually contraindicated in the elderly due to side-effects such as increased confusion, urinary retention, blurred vision, etc. Levodopa (usually given in combination with a decarboxylase inhibitor) often modulates the tremor in PD in addition to reducing rigidity and bradykinesia. The rule of thumb is to “start low and go slow.” Start with levodopa 100 mg and carbidopa 25 mg. Use half a tablet two to three times per day, or use levodopa 50 mg and benserazide 12.5 mg, one capsule, bid. One can also use amantadine, starting with 50 mg to 100 mg od and increased, as tolerated, to bid. This drug is best used during the day and not near bedtime as insomnia and hallucinations are not infrequent in the elderly. The benefit usually lasts only six to 12 months. Dopamine agonists such as bromocryptine, pergolide and pramipexole tend to be less effective for tremor than the other symptoms of PD, but can be tried, especially if there is a poor response to levodopa.

Essential Tremor—The two most commonly used drugs are beta blockers and the anticonvulsant primidone. Both have frequent adverse effects in the elderly and the beta blockers are contraindicated in patients with asthma or significant reactive airway disease. Both beta blockers and primidone are more effective for limb tremor, and are less effective in reducing voice and head tremor.

Examples of beta blockers are:
- Propranolol 40—320 mg per day;
- Metoprolol 50—100 mg bid;
- Nadolol 40—80 mg per day; and
- Atenolol 50—100 mg per day.

Propranolol is the classic beta blocker for ET, but hydrophilic (water soluble) beta blockers such as atenolol or nadolol may be less likely to cause central nervous system (CNS) side effects (depression, confusion, etc.) in the elderly.

Primidone is probably equally effective in the treatment of ET compared to beta blockers. There can be significant side effects, however, and patients should be warned that the initial dose(s) can produce an idiosyncratic reaction of severe dizziness, ataxia and nausea. Start with a low dose (62.5 mg taken at bedtime) and increase by 62.5 mg every seven to 10 days, as tolerated, up to 250 mg per day. This may have to be split into two or three divided doses). A combination of primidone and a beta blocker is sometimes effective when each drug individually fails.

A botulinum toxin type A injection can be effective for head and voice tremor. This should only be given by experienced clinicians, by movement disorder specialists or in a movement disorder clinic.

A variety of other medications have been suggested, including:
- Gabapentin 300 mg to 2400 mg per day;
- Carbonic anhydrase inhibitor methazolamide; and
- Benzodiazepines (these often worsen cognition and increase falls in the elderly).
None of these drugs have been shown to be consistently useful in double-blind trials.

Cerebellar or Action Tremor—Common causes of cerebellar tremor in older adults include multiple sclerosis, infarcts and tumors. Generally, drug treatment is very unsatisfactory. Agents that can be tried include propranolol, isoniazid, clonazepam and carbamazepine. Thalamotomy or thalamic stimulation offers the only hope for severe cerebellar tremor.

Miscellaneous Tremors—Orthostatic tremor is a unique disorder of the elderly where leg tremor is experienced immediately upon standing. While sitting, patients are quite normal, and walking generally lessens the symptoms. This condition responds very well to clonazepam in 50% of patients.

Psychogenic/hysterical tremors, like other hysterical symptoms, are highly variable at different times and tend to diminish when the patient’s attention is distracted. It can be associated with a very bizarre gait disorder. Treatment is directed towards the underlying psychiatric condition.

Surgical Treatment of Tremor
Stereotactic surgery has been successfully used for many years to treat drug-resistant tremor. Currently, the most effective targets for lesioning are:

- The ventrointermediolateral nucleus of the thalamus (thalamotomy) which significantly improves symptoms in 90% of patients with parkinsonian tremor or essential tremor. Patients older than 65 to 70 years are considered poorer candidates for this procedure.
- The posteroverentral pallidum (pallidotomy) which is effective in parkinsonism, but not ET.

More recently, high-frequency, deep brain stimulation (DBS) has been an equally effective alternative to surgery, particularly to the thalamic region. This can be used for both parkinsonism and ET. An advantage of this procedure is its reversibility, as the implanted stimulator can be turned on and off at will. Another advantage is the lower adverse risk of dysarthria with bilateral stimulation, compared with the risks of bilateral thalamic surgical lesions.

Conclusion
Sorting out different tremor disorders in the elderly is challenging, but can be very rewarding in a professional sense. Common causes are parkinsonism and ET. A thorough review of medications is critical (drugs frequently cause drug-induced parkinsonism and can exacerbate postural-type tremor). Medical and surgical treatments for tremor have been outlined.

References

Recommended Reading