What is Tremor?

- Involuntary
- Rhythmic and Oscillatory
- Produced by contraction of alternating muscles
# Classification of Tremors

<table>
<thead>
<tr>
<th>Rest</th>
<th>Action</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Postural</td>
<td>Kinetic</td>
</tr>
<tr>
<td>Parkinsonian</td>
<td>Physiologic</td>
<td>Cerebellar</td>
</tr>
<tr>
<td>PD</td>
<td>Normal</td>
<td>MS</td>
</tr>
<tr>
<td>P-Plus</td>
<td>Enhanced</td>
<td>Stroke</td>
</tr>
<tr>
<td>Secondary</td>
<td>Stress</td>
<td>Degenerative</td>
</tr>
<tr>
<td>Severe ET</td>
<td>Endocrine</td>
<td>Wilson’s</td>
</tr>
<tr>
<td>Myorhythmia</td>
<td>Drugs, toxins</td>
<td>Psychogenic</td>
</tr>
<tr>
<td>Midbrain</td>
<td>ET</td>
<td>Task-specific</td>
</tr>
<tr>
<td>PD</td>
<td>Midbrain</td>
<td>Midbrain</td>
</tr>
<tr>
<td>Dystonic</td>
<td>Neuropathic</td>
<td></td>
</tr>
</tbody>
</table>
How is Tremor Diagnosed?

• History:
  – How it started?
  – When does it happen?
  – What makes it better or worse?
  – Where is it?
  – Do other family members have it?
  – What accompanies it?
How is Tremor Diagnosed?

- **Examination:**
  - Body part and activity
  - Frequency and Amplitude
  - Weakness, coordination, posturing, sensory

- **Labs:** TSH, Electrolytes, Copper (Wilson’s disease), Celiac Disease

- **Neuroimaging:** MRI, DaTSCAN
How do we measure tremor

• Body part
• Amplitude
• Frequency
• Functional severity
Where is Tremor?

- Upper extremity - hands, arm/shoulder
- Head - No-No, Yes-Yes
- Voice
- Leg
- Both sides of the body
- One Side of the body
Location

- Hands: 69.7%
- Head (75% no-no): 40.8%
- Voice: 17.7%
- Leg: 13.7%
- Jaw: 7.1%
- Face: 2.9%
- Trunk: 1.7%
- Tongue: 1.4%
- Orthostatic: 0.6%
Frequency

<table>
<thead>
<tr>
<th>Frequency in Hz</th>
<th>Typical Etiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4 - 4.0</td>
<td>Cerebellar, “ataxic”</td>
</tr>
<tr>
<td></td>
<td>(brainstem, MS)</td>
</tr>
<tr>
<td>4.0 - 4.5</td>
<td>PD (rest), rubral, neuroleptic-induced</td>
</tr>
<tr>
<td>5.5 - 7.0</td>
<td>ET, PD (postural), drug (VPA), voluntary (max. 6 Hz)</td>
</tr>
<tr>
<td>7.0 - 12.0</td>
<td>Physiological, exaggerated physiologic, drug-induced (e.g., epinephrine)</td>
</tr>
</tbody>
</table>
Essential Tremor Frequency

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Frequency</th>
<th>Activation by</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>rest</td>
</tr>
<tr>
<td>Dystonic tremor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parkinsonian tremor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerebellar tremor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holmes tremor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palatal tremor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neuropathic tremor syndrome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drug-induced and toxic tremors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychogenic tremor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NIH collaborative Tremor Severity Scale

• 0 = None
• 1 = Barely noticeable
• 2 = obvious, but probably not disabling
• 3 = moderate, partially disabling
• 4 = severe, coarse and disabling
What Actions Cause Tremor?

• Rest Tremor
• Action Tremor
  – Posture
  – Activity
  – Task or position dependent
• Orthostatic Tremor
Common Types of Tremor

• Physiologic and Stress Tremor
• Essential Tremor- 50% familial
• Associated Conditions-
  – Parkinsonism- 25 to 19% PD patients have ET
  – Dystonia
• Secondary Tremor
  – Medicines
  – Brain lesions- stroke
  – Peripheral Nerve damage
  – Psychological
Medications that cause tremor

- Lithium
- Thyroid medicines
- Valproic Acid
- Bronchodilators
- Stimulants
- Antidepressants- NSRI, SSRI, Bupropion
- Steroids
- Caffeine
DaTSCAN

Parkinson’s disease or other cause of tremor
## ET vs. PD Tremor

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>ET</th>
<th>PD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tremor location</td>
<td>Hands, head, voice</td>
<td>Hands, legs, mouth</td>
</tr>
<tr>
<td>Associated signs</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Duration</td>
<td>Many years</td>
<td>Short</td>
</tr>
<tr>
<td>Family history</td>
<td>60-75%</td>
<td>15-20%</td>
</tr>
<tr>
<td>Alcohol response</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Tremor type</td>
<td>Postural, kinetic</td>
<td>Resting &gt; Postural</td>
</tr>
<tr>
<td>Response to levodopa</td>
<td>-</td>
<td>+++</td>
</tr>
<tr>
<td>Response to propranolol</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Handwriting samples</td>
<td>[Sample handwriting for ET]</td>
<td>[Sample handwriting for PD]</td>
</tr>
</tbody>
</table>
Essential tremor

• 4-12 Hz Tremor, Progressive
• 60% familial, Autosomal dominant
• 50-70% Alcohol responsive

• Description
  – Tremor with action or posture (Rest %)
    – Arms/Hands >90%  Legs 12%
    – Head 33%  Voice 16%  Trunk 3%

• Treatment response:  Medicines 50%
  Lifestyle changes
  Surgery 80-90%
What Causes Essential Tremor

• Familial
  – Family history reported in >50%

• Autosomal dominant pattern of inheritance
  – EMT1, EMT2, Lingo (5%)

• Brain Oscillators and peripheral – muscle and related tissues
Essential Tremor
Annual Incidence

Per 100,000 (Rochester, Minn, 1935-)

10 times more common than PD

Rajput, J Neurol Neurosurg Psychiatry. 1984 May;47(5):466-70
Age at Onset

(N=470 Patients Evaluated in Routine Clinical Practice)

Number of Patients

Age at Onset of Essential Tremor

1 6 11 16 21 26 31 37 42 47 52 57 62 67 72 77 84
Therapy

Mindfulness & Essential Tremor

By Monique Gibson

What is the next step when medical or surgical therapy does not control all of the symptoms of essential tremor? You may be surprised to hear that you have the answer to this common question within you. Understanding how your thoughts, ideas and expectations affect your tremor is the next step toward coping better with ET.

Mind Power

Our mind can be our strongest asset or biggest obstacle when it comes to feeling better. Taking steps to change our habits for healthy living towards a focus on healing requires a commitment from the mind. Your mind will influence how you feel with tremor.

Think about a time when stress was a major part of your life. Did your condition get worse? Or perhaps you started noticing that time of stress amplifies tremor symptoms. Over time, prevented or managed stress can change how we feel.
Medical Treatment

Parkinson's: dopamine, anticholinergics, DBS
Dopamine: agonists, Ldopa, amantadine
Anticholinergics: trihexyphenidyl
Essential tremor: sedatives, muscle relaxants, seizure medicines, DBS
Other tremor: treat primary cause
Medical Treatment

American Academy of Neurology Practice Parameters 2011

Level A - effective
Level B - probably effective
Level C - possibly effective/ineffective
Level U - insufficient evidence
Medical Treatment

American Academy of Neurology Practice Parameters 2011

Primidone, Propranolol – Level A

Alprazolam, Atenolol, Gabapentin, Sotalol, Topiramate - Level B

Nadolol, Nimodipine, Clonazepam, Botulinum toxin A, DBS, Thalamotomy – Level C
Medical Treatment

American Academy of Neurology Practice Parameters 2011

Removed from list:
Levetiracetam, 3,4diaminopyridine - Level B
Flunarizine – Level C
Clozapine, Pregabalin, Zonisamide - Level U
Medical Treatment

Alcohol

- 6 carbon alcohol methylpentynol no effect
- Alcohol infused in limb no effect
- Brain Mechanism of Action

\[ \text{H} - \text{C} - \text{C} - \text{O} - \text{H} \]
Medical Treatment

First Line- Level A

• *Propranolol (60-800mg) and LA (60-800mg)
  – Beta 2> 1 blocker - peripheral
  – 60-240mg reduced tremor 75% patients with 50-70% reduction, ? > 320mg/d
  – Level A Limb, Level B Head
  – S.E. hypotension, low HR, depression, asthma, exercise intolerance, DM caution

• Primidone (25 – 750mg)
  – Improved tremor with or without propranolol
  – ?>250mg/d, 750mg = 120mg propranolol
  – S.E. check liver and cell counts, sedation, lightheadedness, confusion, unable to tolerate
Medical Treatment

Second Line – Level B

• Atenolol, Satolol
  – Beta1 Blocker- mixed results

• Gabapentin (1200-1800mg)
  – Anticonvulsant
  – 1200mg compared with propranolol 120mg- similar
  – Double blind no difference with placebo
  – SE= sedation, lightheadedness, confusion

• Topiramate (25 – 400mg)
  – Anticonvulsant increases GABA, blocks ion channels
  – 400mg- Tremor reduced 20% but 40% drop out
  – S.E= Cognitive function, weight loss, sensory symptoms, kidney stones, birth defects

  – Benzodiazepines- Alprazolam
  – Probably work by reducing anxiety, abuse potential
Medical Treatment

Third Line – Level C
– Nadolol- Beta blocker
– Nimodipine- Calcium channel blocker
– Clonazepam
– Botulinum toxin A- block Ach between nerve and muscle
– Mirtazapine- antidepressant with sedative properties
Medical Therapy

- Not effective for all, 50-70%
- Distal control better than proximal
- 2-3 medicines may be tried
- DBS a consideration
- Side effects are significant limitations
- Stress response of tremor stronger than therapy
Therapy

Mindfulness & Essential Tremor

By Monique Gieser

What is the next step when medical or surgical therapy does not control all of the symptoms of essential tremor? You may be surprised to hear that you have the answer to this common question within you. Understanding how your thoughts, ideas and expressions affect your tremor is the next step toward coping better with ET.

Mind Power

Our mind can be our strongest asset or biggest obstacle when it comes to feeling better. Taking steps to change our habits for health, being aware of the power our mind has over our bodies, and making a commitment to the mind. Your mind will influence how you feel with tremor.

Think about a time when stress was a major part of your life. Did you react well? Or perhaps you felt overwhelmed by the stress of living. Stress can amplify tremor symptoms. Over time, repeated or strong stress can change how we think.

person in the moment of tremor. The power to heal to be and feel whole, to know that you are OK, comes from you.
Nonmedical Treatment

- Nutrition
- Stress v. Relaxation
- Sympathetic Overdrive
- Fatigue v. Strength
- OT, PT, Speech
Nonmedical Treatment

- Occupational Therapy - gadgets, adaptation and ADLs
- PT - strength and fatigue
- Speech - voice therapy
Nutrition for Tremor

• Reduce caffeine and stimulants
  – Coffee, tea, energy drinks
• Minimize glycemic highs and lows
• Enhance relaxation neurotransmitters
Glycemic Index - how much and how fast sugar enters blood stream

www.glycemicindex.com
Enhance Relaxation

Neurotransmitters

• Increase or stimulate GABA
  – Chamomile, Lemon Balm, Lavender
Mind Body Connection
Stress and Stress Reduction
Stress Response

- Stress
- Symp NS
- Tremor
Neurologic Control of Stress
Feedback Loop

- Stress
- Sympathetic NS
- Parasympathetic NS
- Fight or Flight Tremor
- Recovery
Control and Balance

Stress
Sympathetic NS

Recovery
Parasympathetic NS
## Control and Balance of Sympathetic-Parasympathetic Nerve Activity

<table>
<thead>
<tr>
<th></th>
<th>Sympathetic- Stress</th>
<th>Parasympathetic- Relax</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breathing</strong></td>
<td>Take rapid, short, and irregular breaths. Breath shallow breaths taking air into your throat but not deep into the lungs</td>
<td>Slow, big, deep and regular breaths. Bring each breath deep into your lungs. Breath in and exhale slowly.</td>
</tr>
<tr>
<td><strong>Muscle</strong></td>
<td>Tighten and clench your neck, shoulders and fists.</td>
<td>Settle into your chair, relax your neck and shoulders. Rest your hands on your lap and close your eyes.</td>
</tr>
<tr>
<td><strong>Thinking</strong></td>
<td>Take a moment and think about all of the things you need to do today: Taxes, traffic, future unknowns.</td>
<td>Close your eyes and think of a favorite place or time such as the beach or vacation, or the joy and smile of a child.</td>
</tr>
</tbody>
</table>
Mind-Body Techniques

- Breathwork
- Body Scan
- Guided Imagery
- Hypnosis
- Body Therapies- Yoga, Tai chi
- Meditation
- Cognitive behavioral therapy, Positivity
Guided Imagery Helps Tremor

Movement Disorders. 24(14):2059-62, 2009
Mindfulness

• Bringing attention and awareness to the moment
• with intention
• in a nonjudgmental way
Appreciate the Moment
What mindfulness meditation “delivers”

• Ability to experience the present moment

• Clear awareness of thoughts / emotions

• Ability to relate to one’s experience with compassion/understanding

• Ability to experience/transform emotional distress

• Space where creative solutions can arise
Mindfulness

• Way of being in a wiser relationship with one’s experience

• Refinement of attention and awareness, compassion and wisdom

Jon Kabat-Zinn
Effects of Mindfulness

- Cognitive Psychology - attitudes, attention, skills
- Behavior - choices, habits, routine, emotional response, possibilities, openness and resiliency to change
- Biology - brain, autonomic nervous system, hormonal change, metabolism, immunity, inflammation, organ system control
- Spiritual - meaning, purpose, connection
Mindfulness Techniques (Practice)

- Body Scan
- Breathwork
- Sensory Meditation
- Loving Kindness
- Walking Meditation
More Information

• www.DrGiroux.com
Mindfulness & Essential Tremor

By Monique Gibeau

What is the next step when medical or surgical therapy does not control all of the symptoms of essential tremor? You may be surprised to hear that you have the answer to this common question within you. Understanding how your thoughts, ideas and experiences affect your tremor is the next step toward coping better with ET.

Mind Power
Our mind can be our strongest asset or biggest obstacle when it comes to feeling better. Taking steps to change our habits for healthier living toward a focus on healing requires a commitment from the mind. Your mind will influence how you feel with cancer.

Think about a time when stress was a major part of your life. Did your stress get worse? Or perhaps you started using that time of stress to amplify tremor symptoms. Over time, repeated or unnecessary stress can change how we think.