

Controlling Involuntary Tremors

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Tremor

- A rhythmic oscillation that may affect head, trunk or extremities
- Multiple potential causes
 - Essential tremor
 - Parkinson's disease
 - Stress (anxiety, exercise, fatigue)
 - Drug-induced (psychiatric medications, stimulants, alcohol)
 - Illness (thyroid, adrenal)
- Essential tremor (today's topic)
- Parkinson's disease (today's topic)



Essential Tremor

- Epidemiology
- Characteristics
- Diagnosis
- Treatment



Epidemiology

- Most common movement disorder world wide
- About 4% of adults over 40 years old
- True cause remains poorly understood
- Family history is very common, especially if onset before 40 years old
- Probably autosomal dominant inheritance
- Not 100% in identical twins



Characteristics

- Variable characteristics in individuals
- Postural and action tremor from 4-12 cycles per second, usually bilateral and fairly symmetric
- Alcohol temporarily suppresses it in many cases
- Upper extremities in 90%, 30% head, 20% voice, 10% jaw, 10% legs
- Isolated head and voice tremor generally separated from ET
- 50% have some gait problems
- Associated symptoms: cognition decline, depression, anxiety, hearing and smelling deficits

Diagnosis

- No labs or brain scans
- Classic features in the arms with duration of greater than 5 years
- Exclusions: other neurologic findings, known causes of increased physiologic tremor, concurrent tremorogenic drug exposure or drug withdrawal state, recent nervous system trauma, known psychogenic origins, sudden onset or stepwise decline

Treatment

- Considered when impact on quality of life
- About 50% meaningful response rates
- Propranolol and primidone
- Others: sotalol, atenolol, alprazolam, topiramate
- Botox
- Surgical

Parkinson's Disease: Epidemiology

- James Parkinson described in 1817
- 150/100,000 older than 40
- 1 Million in US
- 70 years of age is average diagnosis
- Men perhaps more than women
- Decreased risk: smoking, statins, ibuprofen, caffeine, exercise
- Increased risk: depression, constipation, pesticides, high dairy
- Mostly sporadic but can be genetic

Parkinson's Disease: Characteristics

- Tremor, bradykinesia, rigidity, postural/gait instability
- Tremor
 - Resting predominant
 - One sided
 - 5 cycles per second
 - Intermittent
 - Less with movement
 - Eventual spread to other side
 - Can affect lips, jaw, head, trunk, leg
 - May be internal feeling

Parkinson's Disease: Diagnosis

- In the setting of key clinical features, no extra testing is typically needed
- MRI may help in atypical cases
- Dopamine transported scans sometimes helpful, especially if distinguishing from essential tremor
- Genetic testing no routine

Parkinson's Disease: Treatment

- Dopamine replacement is the standard
- Carbidopa/levodopa 25/100mg dosing one hour before or two hours after meals
- Other medications act like dopamine, e.g., pramipexole
- Prolong dopamine effect, e.g., entacapone, rasagiline
- For refractory tremor, e.g., amantadine, trihexyphenidyl
- Infusions of dopamine or apomorphine
- Surgical interventions

Surgical Treatment of Tremor

*Kara D. Beasley, DO, Mbe, FACOS
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Surgical Options

- Deep Brain Stimulation
- Focused Ultrasound
- Radiosurgical Lesioning

Deep Brain Stimulation

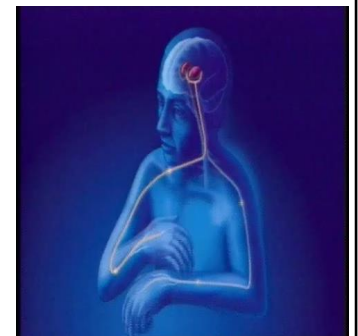
Approved Indications

- **Essential Tremor**
FDA approved in 1997
- **Parkinson's disease**
FDA approved in 2002
- **Dystonia**
FDA approved (HDE*) in 2003
- **Obsessive Compulsive Disorder**
FDA approved (HDE*) in 2009

*Humanitarian Device: Authorized by Federal Law for the use as an aid in the management of chronic, intractable (drug refractory) primary dystonia, including generalized and segmental dystonia, hemidystonia, and cervical dystonia, for individuals 7 years of age and older.

A Pacemaker for the Brain

- Implanted electrode
- Connected to a pacemaker in the chest
- High-frequency electrical stimulation
- Deep structures involved in the control of movement
 - Subthalamic nucleus (STN)
 - Globus pallidus (GPi)
- Stimulation overrides abnormal neuronal activity to bring motor controlling circuits into a more normal state of function
- Reducing movement disorder symptoms



The Components: Lead

Two Types: **Traditional Ring**

spherical stimulation

increase energy = increase size of field

placement critical



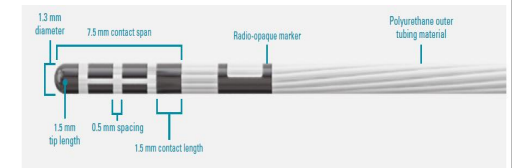
The Components: Lead

Directional

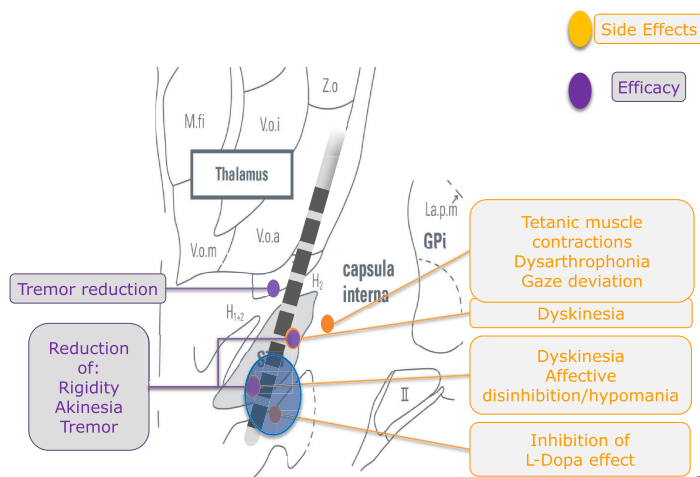
field shaping

fine tune stimulation to effect

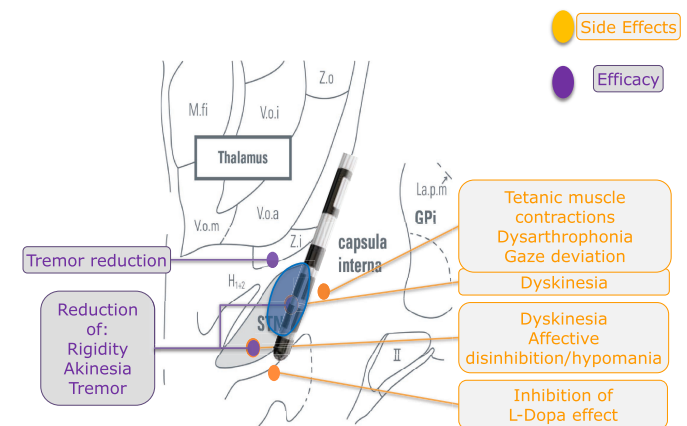
avoid side effects



Goal: Accurately target therapy and avoid unwanted effects



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The Generator: “Battery” and Programmer



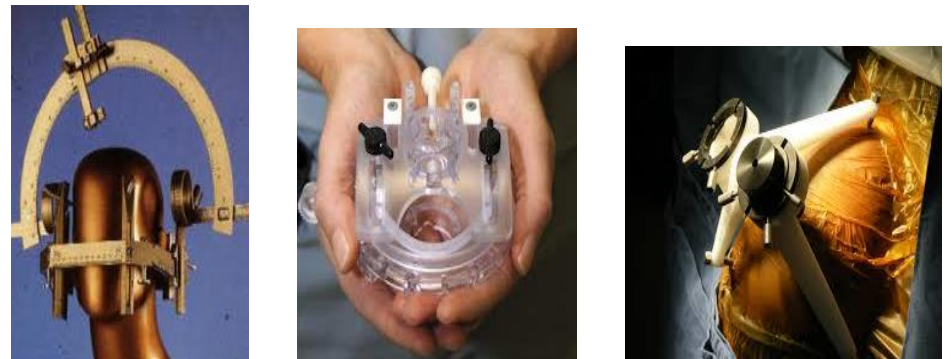
Goal Attainment

- DBS treats the cardinal symptoms of PD
 - Tremor
 - Rigidity
 - Bradykinesia
 - Some types of gait dysfunction
- DBS does not treat cognitive impairment, psychiatric symptoms, axial gait dysfunction
- DBS does not halt the progression of PD
- DBS is not a cure.
- There is a window for DBS and PD!!!

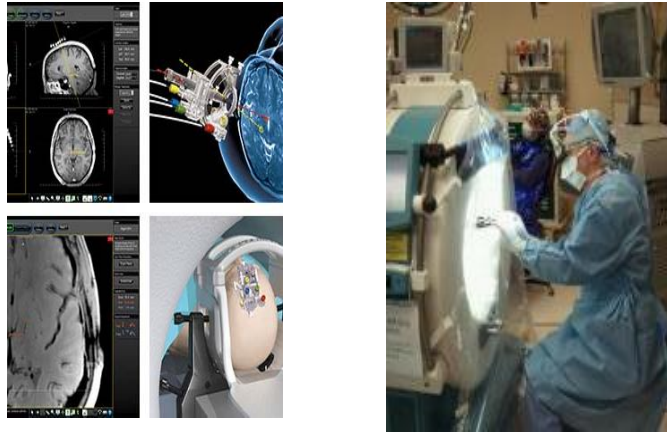
The Team

- Fellowship Trained Functional Neurosurgeon
- Movement Disorder Neurologist
- Neuropsychologist
- +/- Neurophysiologist

Frame vs Frameless



Asleep vs Awake



DBS: Potential Complications and Risks

- **Surgery related**

- Hemorrhage (inherent in any stereotactic procedure); may be silent or symptomatic
- Transient confusion
- Infection (typically occurs at neurostimulator site in chest when it does occur)

- **Stimulation related**

- Usually can be minimized or eliminated by adjusting stimulation settings
- Reversible paresthesia, dysarthria, muscle contraction

Parkinson's Disease

Patient Selection

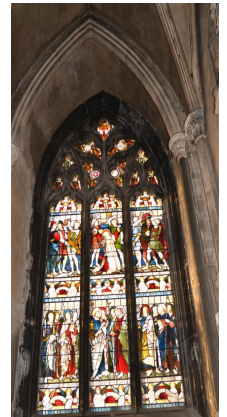
- As Parkinson's disease progresses, medications may fail to provide consistent and adequate symptom control
- Medications used at levels required for symptom control may produce adverse effects
 - Motor complications, such as dyskinesia
 - Cognitive and psychiatric problems
 - Nausea, hypotension, and other systemic effects

When Should DBS Be Considered?

- When, despite optimized pharmacotherapy, you experience troubling motor symptoms:
 - Wearing off – Off periods that contain troubling bradykinesia, rigidity, tremor, and/or gait difficulty
 - Troubling dyskinesia
 - Motor fluctuations
 - Refractory tremor

The Window

- Atypical (non-idiopathic) parkinsonism
 - Multi System Atrophy, PSP
- Lack of response to levodopa
- Frank dementia, moderate to severe dementia



Goal Attainment

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Goal Attainment

If you or a loved one is considering DBS:

- Be sure to clearly discuss goals with your surgeon: what are you unable to do today that you would like to be able to do after DBS?
- Be sure to clearly discuss what expectations may not be met with surgery.

Our Multidisciplinary Team Approach

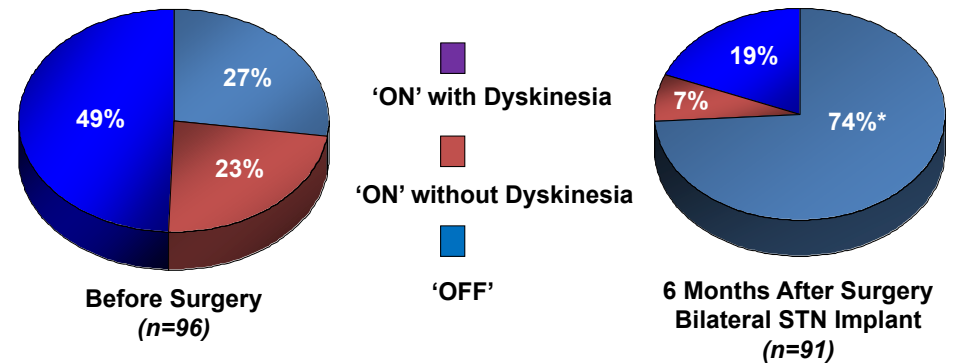
- Neurology
- Neurosurgery
- Neuropsychology
- Psychiatry
- Rehab
- “an ongoing multidisciplinary conversation around patient selection and care provides an important avenue for establishing good practice”

J Med Ethics. 2006 Feb;32(2):106-9.

Stimulating debate: ethics in a multidisciplinary functional neurosurgery committee.

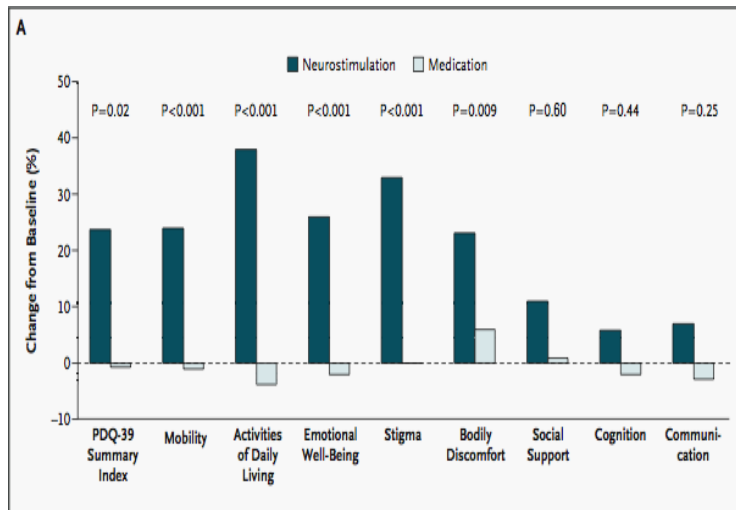


“ON” Time Without Dyskinesias Improves from 27% to 74% of a Patient’s Waking Day*



* The Deep-Brain Stimulation for Parkinson’s Disease Study Group. Deep-brain stimulation of the subthalamic nucleus for the pars interna of the globus pallidus in Parkinson’s disease. *N Eng J Med*. 2001;345:956-63.

Quality of Life Improvement with DBS



JAMA[®]

Online article and related content current as of July 10, 2009.

Bilateral Deep Brain Stimulation vs Best Medical Therapy for Patients With Advanced Parkinson Disease: A Randomized Controlled Trial

Frances M. Weaver; Kenneth Follett; Matthew Stern; et al.

JAMA. 2009;301(1):63-73 (doi:10.1001/jama.2008.929)

“Conclusions: In this randomized controlled trial, deep brain stimulation was more effective than best medical therapy in alleviating disability in patients with moderate to severe PD with motor complications responsive to levodopa and no significant cognitive impairment.”

Early Stim Trial: NEJM

- 251 patients who had just started having mild fluctuations and were still responding fairly well to drugs
- randomly selected to be in one of two groups, one receiving medication alone and the other receiving medication plus deep brain stimulation
- Patients in the deep brain stimulation group experienced an improvement of 26 percent in their quality of life.

Gunther Deuschl, M.D., Ph.D., chairman, neurology, University Medical Center Schleswig-Holstein, Kiel, Germany; Carlos Singer, M.D., professor, neurology, and director, division of Parkinson's disease and movement disorders, University of Miami Miller School of Medicine; Feb. 14, 2013, New England Journal of Medicine



Early Stim

- mobility was also improved in the combination group
- findings suggest that "**instead of waiting** for patients to have very marked fluctuations, peaks and very deep valleys, [we] move in when the peaks and valleys are not that steep," Singer
- "The data suggest that patients can **safely, and with significantly better outcome, receive neurostimulation**," said Deuschl. "We expect that the international guidelines will change at this point, and the patients will be offered **neurostimulation at a much earlier time**."



Essential Tremor



Essential Tremor Guidelines

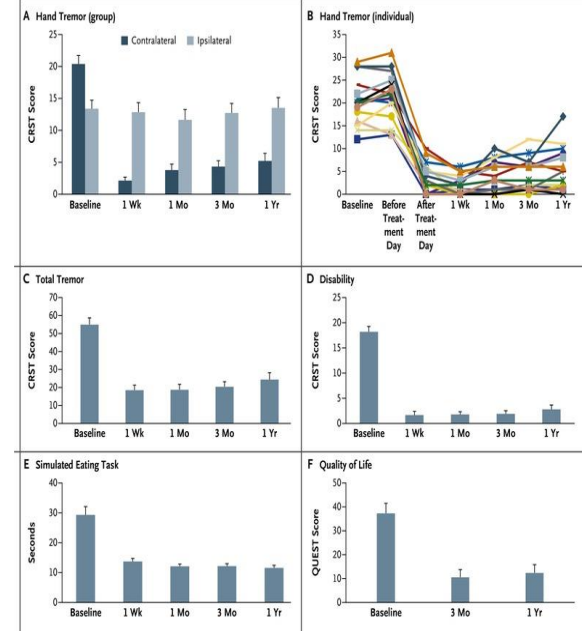
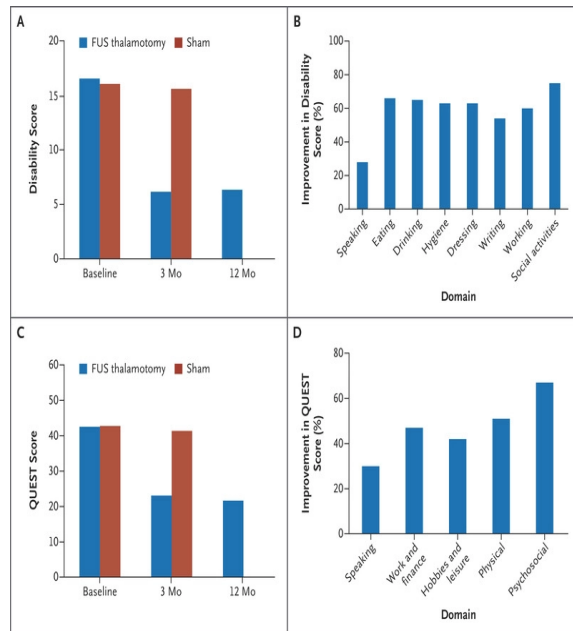
Guidelines published by the American Academy of Neurology (AAN) in June 2005 concluded that:

- Unilateral DBS resulted in a significant (60 to 90%) reduction of contralateral limb tremor.

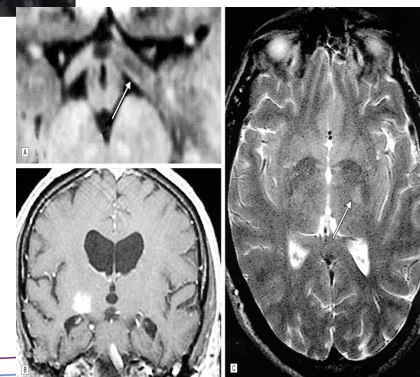
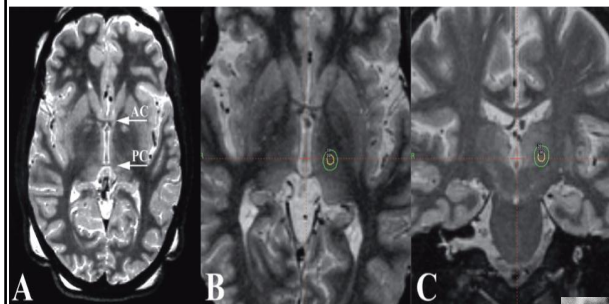
Zesiewicz TA, Elbe R, Louis ED, et al. **Practice Parameter: Therapies for essential tremor. Report of the Quality Standards Subcommittee of the American Academy of Neurology.** *Neurology* 2005;64:2008-2020



Focused Ultrasound



Radiosurgical Lesioning



Questions?

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