



## Managing Patients with Implanted Neurostimulators

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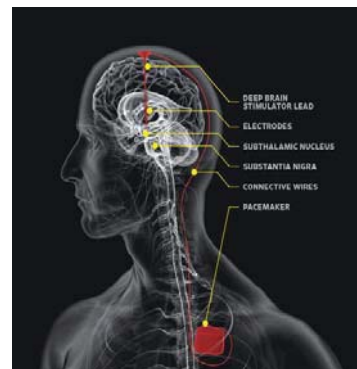
## Today in the O.R.

- Your patient is a 64 year old male scheduled for partial colectomy for cancer
- He has a history of hypertension, CAD s/p MI 4 years ago and has two coronary stents, and BPH
- The patient informs you that part of his treatment for Parkinson's is deep brain stimulation (DBS) placed last year
- Patient asks you if he should do anything special with the DBS

## Deep Brain Stimulation

- Approved by FDA since 1997
- Leads are surgically implanted in the basal ganglia (subthalamic nucleus, Globus Pallidus interna, or ventral intermediate nucleus of thalamus) and deliver high-frequency stimulation
- Extension wires from the leads are tunneled under the skin of the neck to the battery case/generator which is placed in the chest wall below the clavicle (like a cardiac pacemaker)
- Generator is programmable for frequency/voltage

## Deep Brain Stimulation



## Deep Brain Stimulation

- DBS mimics the inhibitory effect of dopamine from the substantia nigra which was lost
- Used for Parkinson's, Essential Tremor, Dystonia, and possibly psychiatric disorders
- The DBS system is prone to heat conduction and affected by magnetic devices/electrical fields
- This heat conduction can cause catastrophic sequelae at the *electrode tip*

## Deep Brain Stimulation

### Specific Contraindications and Precautions

- Monopolar electrocautery can damage the lead or extension. Bipolar cautery should be used. If monopolar is necessary the ground plate should be as far away from system as possible; DBS system should be turned off and voltage set to zero.
- If obtaining a 12-lead EKG, the DBS can cause 60-cycle interference and a less accurate reading. Turn DBS off.

### Deep Brain Stimulation

#### Specific Contraindications and Precautions

- MRI:
  - do not use full body RF coil or head transmit coil that extends over chest
  - MRI can induce voltages in stimulator or lead causing jolting or shocking levels of stimulation
  - for brain MRI, system should be off, voltage set to zero, programming set to bipolar
- CT scans: Safe, no changes needed
- Transcranial magnetic stimulation – avoid!

### Deep Brain Stimulation

#### Specific Contraindications and Precautions

- Diathermy: absolutely the worst!
  - shortwave, microwave, or therapeutic ultrasound diathermy are used for deep muscle heating (physical therapy)
  - energy can be transferred through any component of system and cause either system damage and/or permanent nerve/tissue damage
  - this has led to permanent brain damage and death

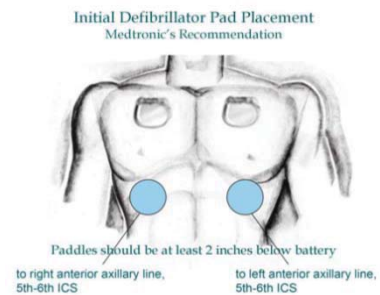
### Deep Brain Stimulation

#### Specific Contraindications and Precautions

- Emergency External Defibrillators:
  - can damage DBS systems and induce currents in leads/extensions
  - no clinical testing has been done
  - position paddles at least 2, but preferably 6-8 inches away from implanted neurostimulator
  - keep paddles horizontal (perpendicular to implanted batteries)
  - use lowest clinically appropriate energy level

### Deep Brain Stimulation

#### Specific Contraindications and Precautions



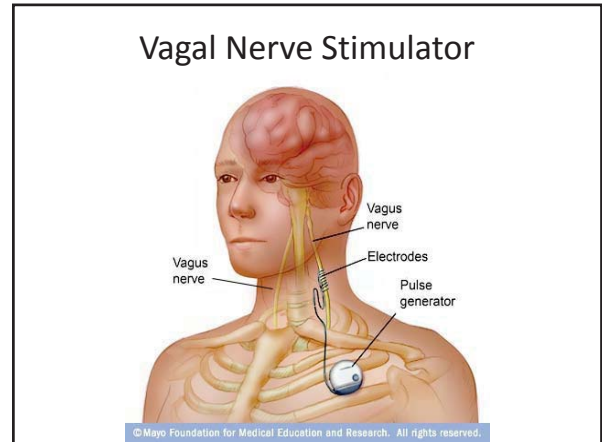
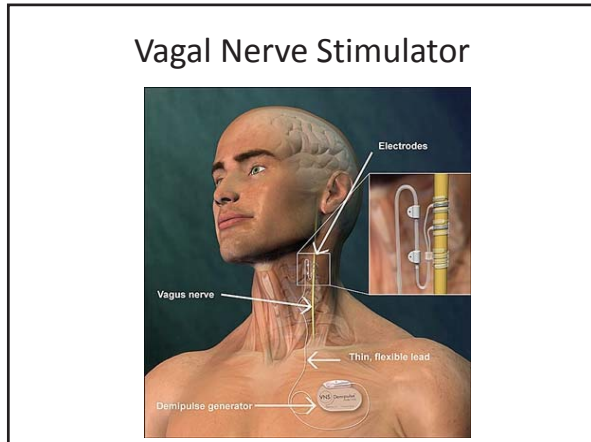
### Deep Brain Stimulation

#### Specific Contraindications and Precautions

- Theft detection and Airport security screening:
  - may cause stimulation system to switch on and off
  - may cause momentary increase in perceived stimulation
  - abrupt cessation of stimulation may cause return of symptoms, perhaps with greater intensity
  - for hand search, do not hold wand-type metal detector over stimulator for more than few seconds

### Vagal Nerve Stimulator

- Approved in 1997 to treat partial-onset epilepsy
- About 50% of patients experience a 40% or so reduction in seizure frequency
- Also used for refractory depression
- Afferent fibers of vagus nerve project to nucleus of the solitary tract (NTS)
  - Alteration of Norepi release by projections of NTS tract to locus coeruleus
  - Elevated levels of inhibitory GABA
  - Inhibition of aberrant cortical activity by reticular system activation



- ### Vagal Nerve Stimulator
- Typically implanted on the left because stimulation of the right vagus nerve causes bradycardias
  - Like the DBS, diathermy is contraindicated in patients with VNS
  - Diagnostic ultrasound is safe
  - VNS may cause or exacerbate sleep apnea
  - VNS may cause bradycardia – treat using standard ACLS protocols

- ### Vagal Nerve Stimulator
- VNS may cause swallowing difficulty with aspiration
  - Patients may have hoarseness from VNS
  - Full body MRI is contraindicated – heat will be induced in the lead and can cause injury
  - Strong electric or magnetic fields may cause generator to cease operation
  - External defibrillation may damage the pulse generator

- ### Vagal Nerve Stimulator
- Electrocautery and radiofrequency ablation devices can cause damage to the pulse generator