Parkinson’s Disease

- What is Parkinson’s Disease?
  - An illness of the brain that gets worse over time and leads to problems with movement. The cause is not known.
  - People with PD lose brain cells in a part of the brain called the substantia nigra. It is found deep in the middle of the brain.

4 Main Motor Symptoms:
- Tremor (shaking)
- Rigidity (muscle stiffness)
- Akinesia/bradykinesia (lack of movement or slowness)
- Postural instability (poor balance)
Motor Fluctuations: Rise and Fall in Symptom Control During the Day

- Wearing off of medication effects
- Sudden or unpredictable swings from good to poor movement
- Half of people with Parkinson’s disease develop motor fluctuations after 5 to 9 years of levodopa treatment*
  - 7 out of 10 after 15 years*


Dyskinesia: Uncontrolled Movements

- Often occur when medicine dose is too high
- Can also occur as dose wears off
- More than 4 out of 10 people with Parkinson’s disease suffer from dyskinesia after 5 to 9 years of levodopa treatment*


Effect on Quality of Life

- People with advanced Parkinson’s disease lose the freedom to live their lives fully because they:
  - Spend many hours of the day with poor movement
  - Go through sudden swings from good to poor movement
  - Have trouble controlling movement due to dyskinesia
  - Become unable to do the things they enjoy
Goal of Current Treatments

Increase periods of good mobility
- "On" time without dyskinesia

Make periods of poor mobility better
- "Off" time: periods of poor mobility when medicine is not providing good symptom control
- "On" time with dyskinesia (uncontrolled movements)

Today’s Current Treatments

Levodopa

<table>
<thead>
<tr>
<th>Generic and brand name?</th>
<th>Levodopa/carbidopa (Sinemet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>When is it used?</td>
<td>Taken 2 to 3 times a day (in early stages) and more often as disease gets worse</td>
</tr>
<tr>
<td>What benefits does it provide?</td>
<td>Improves motor symptoms (tremor, rigidity, akinesia/bradykinesia)</td>
</tr>
<tr>
<td>How does it work?</td>
<td>It breaks down into dopamine in the brain</td>
</tr>
<tr>
<td>Risks/Side effects?</td>
<td>Motor fluctuations and dyskinesia</td>
</tr>
</tbody>
</table>
### Dopamine Agonists

<table>
<thead>
<tr>
<th>Generic and brand names?</th>
<th>Pramipexole (Mirapex®) and ropinirole (Requip®)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>When are they used?</td>
<td>Early stages of the disease. Can be used alone or with levodopa</td>
</tr>
<tr>
<td>What benefits do they provide?</td>
<td>Improve motor symptoms (tremor, rigidity, akinesia/bradykinesia)</td>
</tr>
<tr>
<td>How do they work?</td>
<td>Much like dopamine</td>
</tr>
<tr>
<td>Risks/Side effects?</td>
<td>Dizziness, drowsiness, nausea, hallucinations, confusion, headache, confusion, and constipation</td>
</tr>
</tbody>
</table>

*Mirapex is a registered trademark of Boehringer Ingelheim Pharmaceuticals, Inc. Requip is a registered trademark of GlaxoSmithKline. 

### MAO-B Inhibitors

<table>
<thead>
<tr>
<th>Generic and brand names?</th>
<th>Selegiline (Eldepryl®)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>When are they used?</td>
<td>Advanced stages</td>
</tr>
<tr>
<td>What benefits do they provide?</td>
<td>Give mild control of symptoms</td>
</tr>
<tr>
<td>How do they work?</td>
<td>Slow the breakdown of dopamine in the brain</td>
</tr>
<tr>
<td>Risks/Side effects?</td>
<td>Severe headache, redness, sweating, convulsions, dizziness, nausea, drowsiness, confusion, anxiety, unusually high blood pressure, dyskinesia, mood or other mental changes</td>
</tr>
</tbody>
</table>

*Eldepryl is a registered trademark of Somerset Pharmaceuticals, Inc.

### COMT Inhibitors

<table>
<thead>
<tr>
<th>Generic and brand names?</th>
<th>Entacapone (Comtan®) is sold alone or with levodopa (Stalevo®)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>When are they used?</td>
<td>Advanced stages when motor fluctuations appear</td>
</tr>
<tr>
<td>What benefits do they provide?</td>
<td>Improve motor fluctuations (increase daily &quot;off&quot; time by 1.1 to 1.5 hours)</td>
</tr>
<tr>
<td>How do they work?</td>
<td>Help make sure that more levodopa reaches the brain by blocking an enzyme that breaks down levodopa</td>
</tr>
<tr>
<td>Risks/Side effects?</td>
<td>Dizziness, hypokinesia, nausea, drowsiness, dizziness, constipation, fatigue, hallucinations, other mental disturbances, low blood pressure and discolored urine, sweat and saliva</td>
</tr>
</tbody>
</table>

*Comtan and Stalevo are registered trademarks of Novartis Pharmaceuticals Corporation.
Surgical Treatment

- Deep Brain Stimulation
  - Subthalamic Nucleus

- Stereotactic Lesion
  - Thalamotomy (VIM)
  - Pallidotomy - Globus Pallidus

- Stereotactic Radiosurgery
  - Thalamotomy (VIM)
  - Pallidotomy - Globus Pallidus

Deep Brain Stimulation

Deep brain stimulation (or DBS) is a procedure that involves the implantation of a device which sends electrical impulses to specific parts of the brain for the treatment of Parkinson’s.

- Part One: Electrodes are placed in the brain and the manifestation is dependent upon where the dysfunction is occurring. With Parkinson’s Disease, we are targeting the Subthalamic Nucleus. To treat essential tremor, we target the Thalamus.
- Part Two: The medical device, the brain pacemaker, is implanted and we can begin sending electrical impulses through the implanted electrodes to specific parts of the brain to treat movement malfunction.

Current Technology for DBS

- Acquire MRI scan prior to the surgery
- Perform pre-operative planning
- Attach fiducial frame on the day of operation
- Acquire CT scan with the fiducial frame bolted to skull
- Register plan from preoperative MRI to CT
- Use stereotactic frame system (arc) to align the lead guide cannula and insert
Part One With Mazor Robotics

Here at Bryan Health we have integrated a new technology to assist the surgeon with DBS procedures called the Mazor Robotics Renaissance System. Bryan Health is one of four sites in the country with the technology. Mazor Robotics is a leading innovator in spine and brain procedures that strives to provide a safer surgical environment for patients and surgical staff.

DBS Procedure with Mazor Robotics Renaissance System

Benefits to the Patient:

- Small, frameless platform may improve patient comfort and increase freedom of movement during the procedure.
- Surgeon can pre-plan the optimal trajectories prior to the surgery.
- Provides surgeon with 360 degree working volume, allowing for intraoperative flexibility.

Step 1: Plan

- A Renaissance brain procedure begins with a pre-operative MRI scan of the patient.
- The scan is uploaded into Renaissance’s pre-operative 3D software for surgeons to plan the optimal trajectories prior to the procedure.
Step 2: Mount

- The software identifies optimal locations to place the base for mounting the platform.
- The surgeon selects one of the optimal locations and mounts the base to the patient's skull with three points of fixation using local anesthesia.

Patient benefits:
- Less invasive than stereotactic frame
- May improve patient comfort and increase freedom of movement during the procedure

Step 3: Fuse

- The marker is attached to the platform and then a CT scan is taken.
- The CT scan is then fused with the pre-operative MRI scan to enable execution of the surgical plan.

Step 4: Operate

- After the scans are fused, the guidance unit is attached to the base.
- The surgeon can then send the guidance unit to the planned trajectories.

Surgeon benefit:
- Full 360 degree working volume to operate multiple trajectories with ease
Part Two: Placement of the Pacemaker

- The neurostimulator may be implanted the same day or later.
- The surgeon checks to see that the leads are properly placed.
- The neurostimulator is then placed underneath the skin of your chest and just below the collarbone.
- The surgeon will also connect the lead to the neurostimulator.

The Soletra neurostimulator, connected to the extension and lead. These components are implanted in the body.

The clinician programmer that is used to non-invasively program the Soletra neurostimulator once it has been implanted. The physician programmer is used to adjust the stimulator to maximize benefit and minimize side effects.

End Results

http://youtu.be/AVbB87cv9_w
Questions