Anesthesia Protocol for Performing DBS Procedures (Alterman)
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Background:
Deep brain stimulation (DBS) is currently approved for the treatment of medically refractory movement disorders such as tremor, Parkinson’s disease, and dystonia. Additional indications include Obsessive Compulsive Disorder, depression, Tourette syndrome and others. The DBS device is implanted in two stages. During the first stage, the DBS electrodes are implanted into specific sites deep within the brain (eg. The Subthalamic nucleus). Correct placement within the target is essential in order to achieve the desired result. As these targets are small in size and often difficult to visualize on MRI, physiological confirmation of proper targeting, either through microelectrode recordings or macroelectrode stimulation, is required to confirm proper lead placement. Consequently, it is desirable for the patient to be fully awake during this stage of the procedure so that the recordings are not affected by centrally acting anesthetic agents and the patient is interactive enough to be examined for both beneficial and adverse effects of test stimulation. Of course, this is not always possible. Patients with severe generalized dystonia may not tolerate a prolonged awake surgery; other patients are simply not psychologically capable of undergoing brain surgery while fully awake.

The anesthesiologist plays a critical role in the successful performance of DBS procedures. Patient comfort is of paramount importance. Helping to keep the patient relaxed allows the surgeon to focus on the task at hand, which is detail-intensive. Blood pressure control is critical in order to prevent hemorrhage, the most catastrophic potential complication of this procedure and a complication Dr. Alterman has not experienced since 2005. Finally, judicious use of short acting sedative can help in the acquisition of high-quality MRI images, which improve our initial targeting, reducing both the duration and risk of the operation.

1. Frame Application
   1.1. The stereotactic headframe is applied in the holding area on the morning of the operation. This is the most uncomfortable and also the most overlooked step of the entire procedure. It is important that the frame be applied in a specific orientation in order to facilitate targeting. In my experience, a frame that is applied askew may still be used but it increases the difficulty of targeting and invites errors. I prefer that the patient be awake enough during this part of the procedure that they can hold their own head up as this assists in a straight, orthogonal frame application. Local anesthetic (1:1 mix of lidocaine and marcaine) is administered to the scalp at the pin insertion sites. The discomfort comes from the ear bars that help to center and align the frame. These earbars are temporary; they are removed as soon as the frame is fixed to the cranium.
   1.1.1. Fentanyl (25 mcg) is sufficient to keep most patients calm during this part of the procedure
   1.1.2. Patients with severe anxiety or generalized dystonia may require Propofol sedation in the OR for frame application but this is rare in adults.
2. **Imaging**
   2.1. Dr. Alterman prefers to perform his targeting MRI on the day of surgery for three reasons: 1- He is there to monitor the quality of the targeting images; 2- CT/MRI merges performed with software are not always reliable; 3- anesthesia is available, if necessary, to sedate and monitor the patient so that high quality targeting images can be obtained.
   2.1.1. The decision to sedate the patient in MRI is made on a case by case basis. Check in with Dr. Alterman about this at the start of the procedure.

3. **In the O.R.**
   3.1. The patient is positioned supine with the head elevated 30-40 degrees.
   3.2. Nasal Cannula O₂ with End-Tidal CO₂ monitoring is preferred.
   3.3. Antibiotic Prophylaxis is always given
   3.3.1. Ancef or Vancomycin
   3.4. Blood Pressure control is critical. Dr. Alterman requires that the SBP be 100-140 mm Hg.
   3.4.1. This is most commonly an issue with PD patients whose Sinemet is withheld for the DBS procedure. Sinemet (Carbidopa/Levodopa), the most common medication used to treat PD, lowers BP. Witholding the Sinemet leads to a rebound hypertension that must be controlled in order to perform the surgery safely.
   3.4.2. Preferred Meds: Labetalol, Hydralazine and Nicardipine.
   3.4.3. NTG and Nipride are not desirable

3.5. **The Scalp Block**
   3.5.1. Dr. Alterman prefers a full scalp block for the procedure. It increases patient comfort and reduces the need for sedation. The scalp block should be performed when the patient enters the room after imaging, while Dr. Alterman is planning the surgery on the stereotactic workstation. *Mild propofol sedation may be used for administering the block*, which may be painful. Often, the nurse will insert a foley catheter at the same time.

3.6. **The Operation**
   3.6.1. BP control.
   3.6.2. Patient reassurance/comfort
   3.6.3. Monitor for Venous Air Embolus (Coughing, ↓ ETCO₂)

4. **Post-operative Imaging**
   4.1. The patient may require sedation in order to perform the post-operative MRI. Check with Dr. Alterman regarding this.