

Update on Electroconvulsive Therapy and Other Brain Treatments

Summarized by Thomas T. Thomas

Knowledge about the brain is increasing, and new treatments are emerging to help people who do not respond to medication for brain disorders. **Robert Dolgoff, MD**, the speaker at our March 28 meeting, is an expert in these therapies. He is Medical Director of Mental Health Services at Alta Bates Medical Center, Medical Director at the Berkeley Therapy Institute, and Associate Professor of Clinical Psychiatry at the University of California San Francisco. This year he is also President-elect of the Northern California Psychiatric Society. He discussed modern use and techniques for electroconvulsive therapy (ECT) as well as transcranial magnetic stimulation and deep brain stimulation treatments.

“As psychiatric therapy enters the 21st century,” Dr. Dolgoff said, “we face a disappointment: the most effective treatments we know have all been around for about 50 years.” Electroconvulsive therapy, his own specialty, has been available since 1938. Antipsychotic medications, even the newer ones like Abilify and Geodon, while they may offer fewer side effects now than the older medications, still work on the dopamine system in the brain. Antidepressant medications, even newer ones such as Cymbalta, work on the serotonin system. And both of these systems have been the focus of successive generations of medications for about 40 years. In the meantime, new medications, such as those antagonizing the glutamate system, are only just being explored.



ROBERT DOLGOFF, MD

The current generation of medications represent a serious problem, he said. They diffuse throughout all parts of the body and all parts of the brain, rather than focusing on the specific area of interaction. This general diffusion is what causes the side effects. The same problem is found with chemotherapy for cancer: most of these drugs are toxic, but they are just more toxic to the tumor than to the body itself. Cancer therapies are beginning to develop medications that focus on the tumor, and psychiatric medications should follow the same path. Luckily, with 40 years of studies to rely on, we can say that the side effects of most psychotropic medications are short term only, although lithium can cause thyroid damage and some of the movement disorders associated with certain drugs may be permanent.

“Something newer than these drugs is needed to treat major depression,” he said.

Electroconvulsive therapy is not new—and, like the medications, the seizures it produces still generally affect the whole brain rather than targeting a specific system. Yet ECT is a proven therapy and is the best treatment for resistant depression, Dr. Dolgoff said. And the newer forms of ECT do target the broken parts of the brain. For example, magnetic seizure therapy (MST) uses a magnet to create an electrical field that stimulates only a small part of the brain, although the result is still a general seizure. Other new therapies for depression include vagus nerve stimulation (VNS), transcranial magnetic stimulation (TMS), and deep brain stimulation (DBS). Some of these are discussed in more detail below.

ECT is a serious procedure that includes side effects and risks, and so it is not a first-line therapy. Usually it is given to patients who have tried five or six different antidepressant medications without result. But neither is ECT a last resort, Dr. Dolgoff said. People who fail to respond to ECT sometimes do get better with other treatments. The success rate in treating depression with ECT is about 75%, with success measured on a validated, standard scale incorporating patient responses to questions about psychological symptoms. This battery of questions is administered both before and after the treatment to measure success. Dr. Dolgoff distinguished between “response,” where there is improvement in symptoms, and “remission,” where symptoms disappear. Of the patients who respond to ECT, about half feel completely better and half are somewhat better but still feel depressed. And 25% of patients exhibit no response to ECT.

The usual course of ECT is 12 to 18 individual treatments administered at a rate of three times a week over a month to six weeks. One or two treatments are almost always ineffective, but the patient usually starts responding after four or five. The psychological battery is administered during the course, and the psychologist knows to end the treatments when the patient who has been getting better with each one reaches a plateau and no longer responds. Sometimes, if a patient responds well to the course of ECT but is still susceptible and starts getting depressed in the six months following the treatment, he or she may be put on “maintenance treatments.” Such therapy is marked by one session every three weeks or once a month. The amount of attention the patient gets can also be important. Dr. Dolgoff noted that forty years ago the average hospital stay was two or three months with continuous observation and therapy, while today a patient is usually hospitalized for only six or seven days—and even then only under extreme circumstances.

“ECT is given almost exclusively to voluntary patients in California,” he said. “There is a court procedure for involuntary treatment, but it is seldom used.”

When ECT was first developed, there were few effective treatments for psychiatric disorders, not even Thorazine. So ECT was used for many conditions, even those for which it has no effect. ECT can be used to treat bipolar patients during the depressed state, but like antidepressants it can make people manic and so might trigger mania in bipolar patients. ECT is not a treatment for schizophrenia, he said, except for patients suffering catatonia and nearing death. It is ineffective with obsessive-compulsive disorder [OCD] and seasonal affective

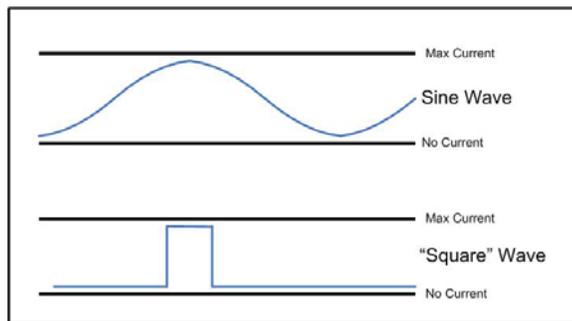
disorder [SAD]. ECT is basically used for treating unipolar patients suffering major depression.

“The early treatments sometimes were not well done,” Dr. Dolgoff said. “Patients were given too many treatments, bilateral treatments [where the current is passed from temple to temple across the entire brain], and using too much electrical current.” An older form of convulsive therapy using insulin shock, as depicted in the film *A Beautiful Mind*, has since been discontinued because insulin in such quantities is toxic.

The risks and side effects of ECT include short-term memory loss, headache, and nausea. There is a remote chance of an allergic reaction to the general anesthesia given before the procedure, and—rarely—of heart attacks and strokes resulting from the current stimulation or the seizure. Interestingly, there is no increased danger for people subject to epileptic seizures.

Modern ECT procedures also employ methods designed to minimize the risks. For example, instead of administering the current bilaterally, one electrode can be placed on top of the head and the other at one temple. This is called unilateral treatment and only exposes one brain hemisphere to the electrical current. Normally, the charge is put through the non-dominant hemisphere, which for most people is the right side. Since speech and other cognitive centers of the cerebral cortex are found on the left hemisphere, some of the confusion and memory loss are thus avoided. However, only about half of patients respond to unilateral treatment, in which case bilateral stimulation is called for. The treating physician thus has choices: unilateral, left or right hemisphere, and bilateral.

Another improvement in treatment is that the newer ECT machines deliver the electric current not as a sine wave but in square-wave packets. The sine wave—visually, a gently rolling wave of hills and valleys, which is how household alternating current (AC) is delivered—allows for a slower buildup and drop off in the current peak and so delivers more electricity over time. With the “square” wave, current is delivered at full intensity nearly instantaneously and then chopped off, in brief pulses or packets of energy. These pulses produce the required seizure with less total electricity and so create less memory loss.



The procedure is simple. The patient receives an intravenous (IV) drip of medication and enters the treatment room with the ECT machine, where the psychiatrist and nurse are waiting. They inject the patient with a short-term general anesthetic, and the patient falls asleep. They then inject a muscle relaxant, so that the patient will not strain and damage muscles and tendons during the seizure. Part of one limb is fitted with a tourniquet—usually at the wrist—so that the hand or foot does not receive the muscle relaxant. This allows the doctor to observe the trembling of this extremity and so know that a seizure has taken place. If there is no seizure, the patient has not experienced a complete treatment and will not get

better. The doctor then applies the electrode disks to two places on the scalp. The electrical stimulation lasts from one-half to eight seconds, based on the first ECT treatment, during which the doctor delivered a short stimulation to establish the patient's particular seizure threshold. Afterwards, stimulation is given at six times the threshold level. After stimulation, the resulting seizure lasts between 10 and 60 seconds. Once the seizure has passed, the muscle relaxant and anesthetic are allowed to wear off; the patient wakes up and is sent home to rest. The patient is generally tired and confused, and may even ask when the treatment will start, not realizing it's already over. Two days later, the patient comes back for another treatment.

"Because of the confusion, memory loss, and fatigue, nobody actually likes this process," Dr. Dolgoff said. "But everyone likes the relief it brings."

No one understands exactly why depressed patients respond to the seizure, he said. Some doctors theorize that the seizure releases a flood of neurotransmitters in the brain. Others, that the seizure resets the clock in the hypothalamus, a structure in the brain that mediates the emotions. Still others think that, paradoxically, it arouses anticonvulsant effects. And finally, there is a theory that the seizure stimulates growth and branching of nerve cells in the brain, and that more connections are a good thing.

The short-term memory loss associated with ECT treatments usually extends to two or three days before the treatment. Rarely, the patient may lose individual memories going back several years. The patient may also have trouble remembering things going on in his or her life during the period of treatment. All of these memories may never be recovered. The patient will also have trouble learning new things for several weeks or a month after the course of treatment ends. During the treatments, the patient is cautioned about activities that require concentration, like driving or operating machinery.

Another form of brain treatment is transcranial magnetic stimulation (TMS), which is approved for use in Europe and Canada, but not in the U.S. In this case the doctor holds a small electromagnet over the scalp. The magnet rapidly changes poles, which has the effect of creating an electric field that penetrates the brain to about a centimeter in depth. The field causes changes that supposedly have therapeutic effect and can be used to target particular brain structures, but there is no general seizure. Because the entire brain is not bathed in drugs or electricity, this procedure is very attractive. The patient receives treatment every day for four or five weeks. Most report only a tingling in the scalp and sometimes a headache, but no confusion or memory loss. TMS has been shown to be effective in double-blind studies, but the U.S. Food and Drug Administration does not approve it, and the demonstrated effects are not as robust as with ECT. Interestingly, one practitioner has used TMS to target the auditory cortex in cases of schizophrenia, and the "voices" associated with that disease have stopped.

A second form of treatment is deep brain stimulation (DBS). In this procedure a platinum wire is surgically implanted in the brain and an electric pulse stimulator placed under the skin of the chest. This enables selective stimulation of small areas of the brain, just a few millimeters in size. DBS treatment has been used to stop the tremors associated with Parkinsonism. Patients are awake during

the implant procedure and the subsequent stimulation, because the brain has no sensory nerves and cannot register pain. Interestingly, one depressed patient experienced moments of happiness, euphoria, and even giggling flirtatiousness as the wire was placed during surgery and clearly stimulated a part of the brain associated with good feelings. However, these feelings abruptly faded and her depression returned as the wire was correctly located for Parkinsonism. DBS is not yet a procedure for depression, but that single experience offers tantalizing possibilities and, as Dr. Dolgoff suggested, it indicates how fragile our concepts of self-actualization and free will may really be.