A team comprising neurologists, neurosurgeons and radiologists are performing MR-guided focused ultrasound therapy (Exablate Neuro, Insightec, Dallas, TX) at Penn Medicine as an alternative to surgery in patients with essential tremor refractory to medication.

MR-guided focused ultrasound (or simply “Focused Ultrasound”) uses real-time MR imaging to target cells in the ventral intermediate (Vim) nucleus of the thalamus, a part of the brain involved in the emergence of tremor. Once located, these cells are ablated by high-frequency transcranial focused ultrasound. This procedure is completely bloodless, requiring no incision or needle placement. Indicated for patients who do not respond to first-line medications for essential tremor (ET), Focused Ultrasound is an alternative to radiofrequency thalamotomy and deep brain stimulation.

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The most common movement disorder, ET is a progressive neurologic disorder characterized by postural and intention tremors affecting the hands. Although not fatal, ET causes disability of varying degrees and has profound consequences on activity, mood, social functioning and quality of life. Essential tremor can be treated with beta blockers and anticonvulsants. However, tolerance, adverse effects and insufficient efficacy are issues with these agents. Thalamotomy is an effective treatment for ET, but is performed less frequently than it once was, in part because of the advent of deep brain stimulation (DBS).

The latest addition to the armamentarium for ET, Focused Ultrasound is associated with a substantial and durable reduction in tremor. In clinical studies of patients receiving Focused Ultrasound for ET, patients saw a 75 percent improvement in their symptoms in the treated hand at 12 months post-therapy.1

Pennsylvania Hospital is the first in the area to offer Focused Ultrasound, as a non-invasive treatment for ET. The therapy was approved by the U.S. Food and Drug Administration (FDA) for use with 1.5T and 3.0T MRI systems earlier this year.

CASE STUDY
Mr. L, a 61-year-old man, was referred to the Center for Functional and Restorative Neurosurgery for consultation after a 10-year history of bilateral ET. At presentation, Mr. L had significant shaking in his hands and arms, and reported that his quality of life had been severely diminished by the difficulty he experienced using his dominant hand to drive, shave, eat and perform other normal daily activities. Mr. L's previous treatments for ET included beta blockers and anticonvulsants. However, with time, the efficacy of these agents had waned, and he'd begun to experience a variety of unpleasant adverse effects.

Mr. L was apprehensive about surgery or investigational medications. However, upon a comprehensive consultation with neurosurgeon Gordon Baltuch, MD, PhD, neurologist Andres F. Deik, MD, MSEd, and radiologist Robert W. Hurst, MD, he expressed an interest in Focused Ultrasound, impressed by the non-surgical character of the procedure and its potential for a durable effect. After MRI and computerized tomography (CT) scans to determine his eligibility for the therapy, he was deemed an appropriate candidate.

During the procedure, high-intensity ultrasound waves were aimed towards the Vim nucleus of Mr. L's thalamus, under MRI guidance. The treatment began with short, low-energy sonications to the target area; the acoustic power was then slowly increased in stages until a lesion was achieved through thermocoagulation. MRI confirmed the correct location of the lesion. Mr. L was conscious during this time and felt no discomfort. He was monitored closely, and his tremor severity was evaluated at each stage of sonication. He remained in the hospital overnight, and was discharged home the next day.

In the weeks following therapy, Mr. L reported no notable side effects from treatment. His right hand is currently completely tremor-free.

Reference
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FACULTY TEAM
The application of Focused Ultrasound for the treatment of essential tremor involves three principal specialties at Penn Medicine. Penn Neurosurgery provides comprehensive surgical management of disorders of the brain, spinal cord and peripheral nervous system, and is committed to translating leading-edge research into improved patient care. The oldest neurology department in the nation, Penn Neurology pioneered essential treatments and neurodiagnostic techniques in the field. It continues today to diagnose and treat patients with varied neurological disorders and to advance the field of neuroscience by offering new approaches and treatments for neurological disorders. The Penn Radiology department provides clinical care services, including diagnostic and therapeutic imaging technologies. Founded more than a century ago, the Department is internationally recognized for its educational preeminence and research efforts.

Providing Focused Ultrasound Therapy for the Treatment of Essential Tremor at Penn Medicine

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