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Fashion Focus: Neurosurgery for Tremor

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Fashion Focus: Neurosurgery for Tremor

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Relief of medically refractory tremor is one of the most gratifying functional neurosurgery procedures. Stereotactic radiofrequency (RF) ablation of the motor thalamus was introduced in the 1950s, benefiting tens-of-thousands of patients in the following decades (Figure).[1] Gamma knife (GK) lacks an immediate tremor effect to guide targeting; therefore, the advent of high-quality MRI in the 1990s was necessary before it could be used successfully for tremor.[2] By then, thalamic deep brain stimulation (DBS) was available with its early reversibility and stimulation adjustment to maximise efficacy *vs.* adverse effects.[3,4] Consequently, thalamotomy was largely relegated to those who could not undergo, or could not afford, DBS.

Focused Ultrasound (FUS) is the "new kid on the block". This incisionless technique requires a full head shave and relies on low-power sonications to create a reversible thermal lesion, confirming tremor reduction without adverse effects. MR thermography helps visualise lesion placement, before high-power sonications create a permanent thalamotomy.[5]

Iorio-Morin *et al* examined FUS adoption by comparing numbers of scientific presentations and publications with those of other lesioning techniques and DBS.(ref) Scientific interest in all lesioning techniques has increased since 2010, with FUS publications rising more rapidly and eclipsing other lesion modalities since 2013. Randomized controlled trial data were only available for DBS and FUS. Moreover, global registry data show that FUS thalamotomies for essential tremor (ET) numbered >1200 in 2019, compared to <400 by GK in 2018, despite significantly more active GK facilities.

They found no head-to-head comparative studies, but historical data suggest that efficacy is similar between GK and FUS but potentially better with RF. Despite GK patients being older and often taking anticoagulant medication, FUS patients suffered higher complication rates. Moreover, FUS thalamotomies are longer and produce more discomfort than GK. Although variable and challenging to estimate, FUS cost-per-case is probably comparable to GK whereas RF may be less costly. Lesion procedures are likely to be more cost-effective than DBS.

The authors conclude that the popularity of FUS cannot be explained on the basis of efficacy, safety, patient comfort or cost. They rightly question why FUS is flourishing despite a significant side-effect profile, whereas thalamotomy had previously declined when DBS was shown to be safer. They hypothesize that rapid FUS adoption may be explained by a combination of factors: its incisionless appeal and immediate tremor results, superior manufacturer marketing and funding of studies, together with greater leadership, interest and oversight of FUS by functional neurosurgeons. The allure of a fashionable novel technology to both patients and doctors should not be discounted.

Whatever the case, FUS is a welcome addition, improving patient choice in medically refractory ET that has been accompanied by a re-evaluation of lesioning procedures in functional neurosurgery. Long-term comparative studies may provide further efficacy and side effect data for each modality. In practice, ET patients will best be served when they have access to a variety of neurosurgical therapies. Ultimately, local culture, availability and expertise, technical limitations, patient factors and patient preference will determine which modality is used in individual patients.

1 Hassler R, Riechert T. A Special Method of Stereotactic Brain Operation. *J Roy Soc Med* 1955;**48**:469–70. doi:10.1177/003591575504800620

2 Lindquist C, Kihlström L, Hellstrand E. Functional Neurosurgery - A Future for the Gamma Knife? *Stereot Funct Neuros* 1991;**57**:72–81. doi:10.1159/000099557

3 Schuurman PR, Bosch DA, Bossuyt PM, *et al.* A comparison of continuous thalamic stimulation and thalamotomy for suppression of severe tremor. *New England Journal of Medicine* 2000;**342**:461–8. doi:10.1056/nejm200002173420703

4 Benabid AL, Pollak P, Hoffmann D, *et al.* Long-term suppression of tremor by chronic stimulation of the ventral intermediate thalamic nucleus. *Lancet* 1991;**337**:403–6. doi:10.1016/0140-6736(91)91175-t

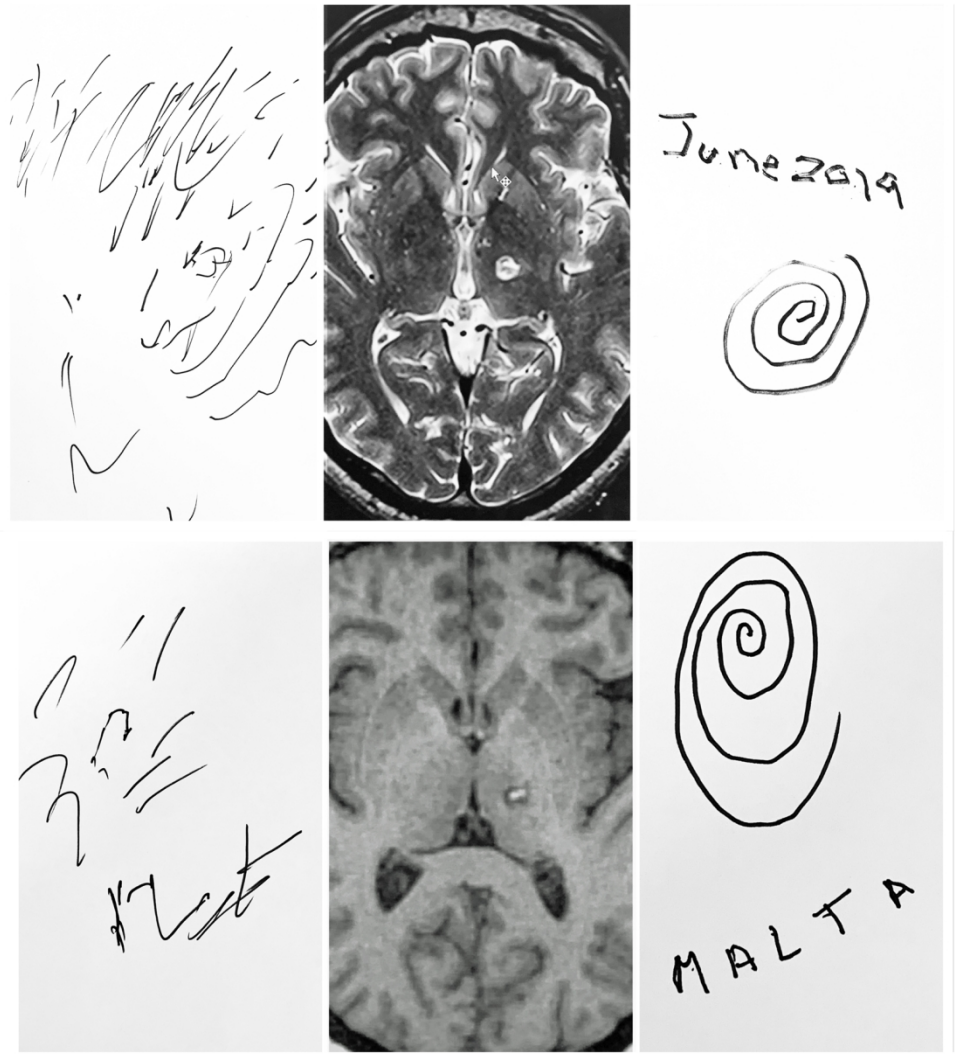
5 Elias WJ, Lipsman N, Ondo WG, *et al.* A Randomized Trial of Focused Ultrasound Thalamotomy for Essential Tremor. *New England Journal of Medicine* 2016;**375**:730–9. doi:10.1056/nejmoa1600159

Highlight:

What factors have driven the rapid adoption of focused ultrasound and what role should it have in the neurosurgical management of tremor?

Figure Legend:

Handwriting before (left panels) and after (right panels) radiofrequency thalamotomy. Axial MRI showing left thalamotomy on T2-weighted MRI (above) and T1-weighted MRI (below)



Handwriting before (left panels) and after (right panels) radiofrequency thalamotomies. Axial MRI showing left thalamotomy on T2-weighted MRI (above) and T1-weighted MRI (below).

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