

Focused Ultrasound Likely Dominates Deep Brain Stimulation and Stereotactic Radiosurgery for Medically-Refractory Essential Tremor: An Initial Decision and Cost-Effectiveness Analysis

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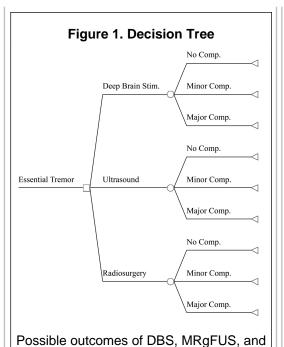
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Methods

PubMed and Cochrane Library searches were performed for studies of MRgFUS, Deep Brain Stimulation (DBS), and Stereotactic Radiosurgery (SRS) for ET. Pre- and post-operative tremor-related disability scores were collected from 32 studies involving 83 MRgFUS, 615 DBS, and 260 SRS cases. Utility, defined as quality of life and derived from percent change in functional disability, was calculated and Medicare reimbursement was employed as a proxy for societal cost. Medicare reimbursement rates have not yet been set for intracranial MRgFUS for ET, so we estimated reimbursements that were approximately equivalent to those of SRS to assess a cost threshold. We then constructed a decision analysis model to examine the most costeffective procedural option for ET, implementing meta-analytic techniques.

Introduction

Essential Tremor (ET) is one of the most common neurologic conditions, yet medical management is frequently suboptimal. A recent phase III study demonstrated that magnetic resonance-guided focused ultrasound (MRgFUS) thalamotomy significantly improves upper limb tremor in medically refractory ET. The present study assesses the cost-effectiveness of this novel therapy in comparison to existing procedural options.



SRS for treating medically-refractory

essential tremor

Results

MRgFUS thalamotomy resulted in significantly higher utility scores when compared with either DBS (p< 0.001) or SRS (p< 0.001). Cost of MRgFUS was significantly less than DBS (p<0.001) but not significantly different from SRS (p=0.654). SRS was the least effective of the three procedures. Pooled patient and procedure demographical information for the three treatment groups were compared. Pairwise comparison found that SRS patients are significantly older than those with DBS (p =0.004). Other pairwise differences did not reach significance. Table 1 shows cost reimbursements (facility and physician payments) for each of the three treatments.

Table 1. Procedural Cost Elements - Medicare Reimbursement (\$US)

| Treatment category | | Professional/ | Facility | lotai | |
|--------------------|---|---------------|----------|--------|------|
| | | technical | | Amount | SD |
| DBS | | | | | |
| | unstaged | | | | |
| | no perioperative complications | 3,850 | 22,460 | 26,310 | 3262 |
| | major perioperative complications | 3,850 | 31,621 | 35,471 | 4398 |
| | staged | | | | |
| | no perioperative complications | 20,667 | 22,460 | 43,127 | 5348 |
| | major perioperative complications | 20,667 | 31,621 | 52,288 | 6484 |
| | perioperative reoperation | 1908 | 0 | 1908 | 237 |
| SRS | | 4,332 | 12,772 | 17,104 | 2121 |
| MRg | FUS* | 5103 | 12,929 | 18,032 | 2236 |
| SRS | or FUS: Additional | 0 | 31,621 | 31,621 | 3917 |

* Medicare reimbursement not yet determined. This value represents an estimate comprised of these codes: DBS intraoperative mapping, MRI, and SRS planning/consultation/use.

Table 2. Effectiveness and Cost Comparisons

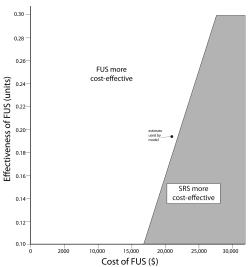
| | Differences (p-values) | | | | |
|------|------------------------|---------------|--------|--|--|
| | | effectiveness | cost | | |
| ·005 | MRgFUS vs.SRS | <0.001 | 0.654 | | |
| 1402 | MRgFUS vs, DBS | <0.001 | <0.001 | | |
| | SRS vs. DBS | <0.001 | <0.001 | | |
| ·003 | | | | | |
| 524 | | | | | |
| | DBS with staging | | <0.001 | | |
| .003 | vs. all others | | | | |
| 614 | | | | | |
| | | | | | |
| .003 | | | | | |
| 1036 | | | | | |
| | | | | | |

Effectiveness measured by amount of utility added by the procedure. The higher the number, the more effective.

Conclusions

These results suggest MRgFUS thalamotomy is cost-effective compared to both DBS and SRS based on the preliminary experience with this novel therapy. It is significantly less costly than DBS, assumed to cost roughly the same as SRS, and is more effective than both. Even if longer follow-up finds some decrease in the effectiveness or higher costs of MRgFUS, it will likely remain competitive with both alternatives.

Figure 2. Two-way Sensitivity Analysis



MRgFUS is predicted to be more cost effective than SRS and DBS

References

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- [2] Young RF, Li F, Vermeulen S, Meier R. Gamma Knife thalamotomy for treatment of essential tremor: long-term results. J Neurosurg 2010; 112: 1311–7.
- [3] Blomstedt P, Hariz GM, Hariz MI, Koskinen LO. Thalamic deep brain stimulation in the treatment of essential tremor: a long-term follow-up. Br J Neurosurg 2007; 21: 504–9.