Deep Brain Stimulation in Refractory Tourette Syndrome Part II

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Age for DBS

- over 18 yrs (Porta et al. 2005)
- over 25 yrs (Mink et al. 2006)
- over 25 yrs (Ackermans et al. 2006)
- over 18 yrs (Müller-Vahl et al. 2011)
- over 20 yrs (Cavanna et al. 2011)

“Inclusion age too high may mean that individuals who are severe TS miss opportunities to prevent deleterious outcomes at crucial developmental stages”

Cavanna et al., 2012

Targeted area for DBS in TS
(Ackermans et al., 2008)

Legends: cingulate cortex (1), corpus callosum (2), frontal lobe (3), nucleus paramedianus complex (4), zona incerta (5), globus pallidus (6), substantia nigra (7), subthalamic nucleus (8), putamen (9), posterior commissure (10), H fields of Forel (11), superior colliculus (12), inferior colliculus (13), optic chiasm (14), superior cerebellar peduncle (15) and dentate nucleus (16).

Personal experience: targets

50 patients with refractory TS since November 2004 were treated in Milano (Galeazzi Hospital):

- 45 Thalamus (CM/Pf-Vo)
- 1 Gpi (posterior)
- 4 Gpi (anterior)
- 9 Nucleus Accumbens
- 2 targets in 9 patients

Lack of predictor tests for DBS in TS
• Preoperative levodopa responsiveness tested in Parkinson’s disease pre DBS
**Rescue procedure**

“De novo and rescue DBS leads for refractory Tourette syndrome patients with severe comorbid OCD: a multiple case report”


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**Complications**

- No intracranial A.E.
- Inflammatory complications at site of hardware most frequent
- Higher incidence of device removal in TS patients: 16% (out of 50 pts) versus 1.6% in other indications (out of 306 pts)
- Poor compliance: 3 out of 50 pts asked removal of device
- Excessive expectation (in pts and care-givers)

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**Future in DBS: patient selection**

- Predictive test?
- Subtypes of TS?
- Targets? (tailoring approach)

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**Future in DBS: target**

fMRI

Activation during motor execution

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**Ventriculo-oralis activity in TS**

Along the track approaching the target the identified firing patterns are specifically localized:

- Irregular firing 6-4 mm above the target
- Oscillatory bursting 3-1 mm above the target
- Silent zone at target

Could help identifying target position.
Parkinson's disease without levodopa is characterized by activity in the low beta band (10-20 Hz) and correlates with clinical manifestations.

The administration of levodopa induces specific modulation of rhythms and rhythm interactions.

Dystonia is characterized by an activity in the low frequency band (2-7 Hz).

Correlation between LFP oscillation and bursting frequency in the low-frequency band.

The abnormal increase of this low-frequency burst and of the associated LFP low-frequency oscillation could be correlated with TS pathophysiology.

Future in DBS: hardware

- Miniaturization
- Stimulation on demand?

- Tayloring approach?
  or
- Fixed procedure?
- Need for clinical trials

Proposed Protocol

- Above 18 years of age with possible exception
- Definitive case of TS according to DSM-IV-TR criteria and DCI
- Preoperative clinical algorithm (1 yrs before) in repeated sessions
- Stable period of severe tics (NGTSS of 35/55 or above) for at least 6 months prior to surgery (and for comorbidity?)
- Tics and coexisting morbidity as primary problem
- Good compliance
- Value of Tourette "by history"?
- Treatment refractoriness
- No medical/surgical contraindications
- Correlation to economical and environmental factors

- At the present time DBS for Tourette remain experimental
  - Possible “compassionate use”
  - Need of International Register
Thanks to

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A I S T o.n.l.u.s.

and to our patients, their relatives and my team..