



Psychosurgery Revisited: Frontal Lobotomy

Lesions Estimated with Diffusion Tensor Imaging

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PURPOSE

We estimated white matter pathways expected to be severed by frontal lobotomy using DTI fiber tractography.

BACKGROUND

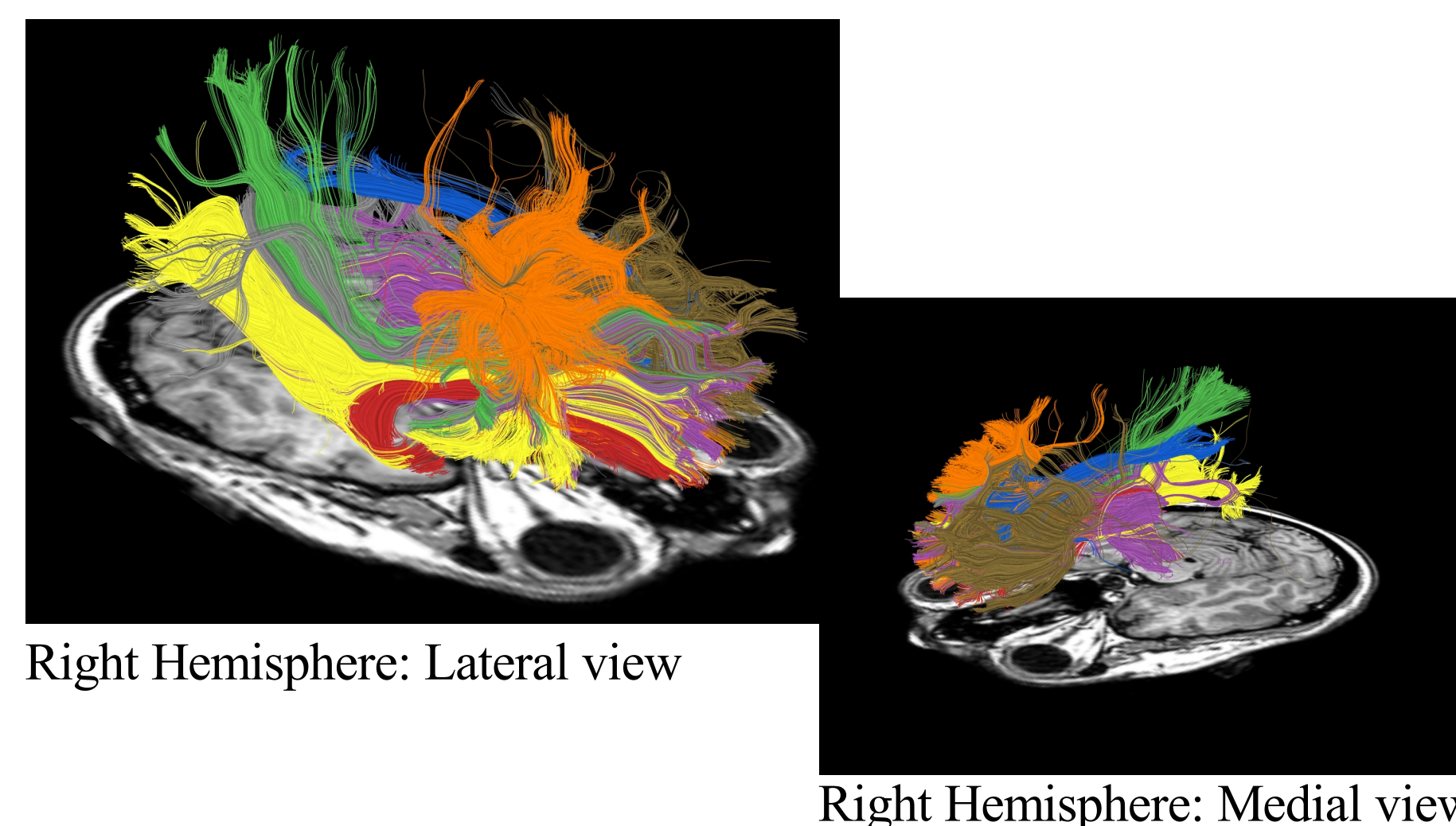
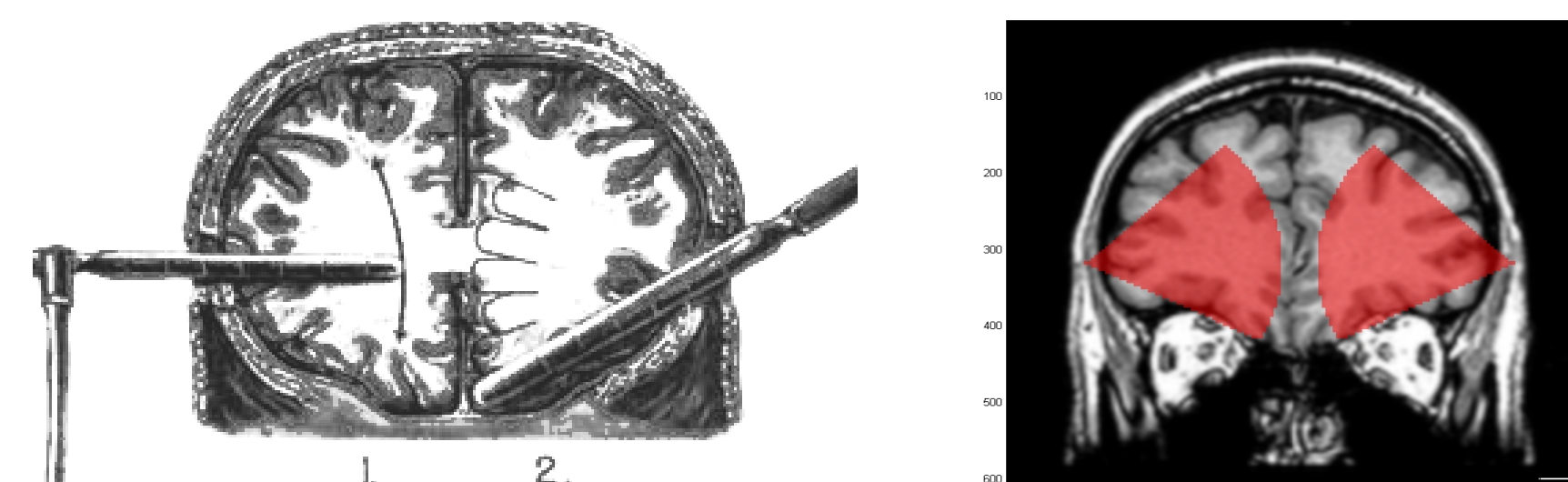
- Lobotomy aimed to treat mental illness by severing frontal lobe white matter pathways
- Two methods were used in the surgery:
 1. Standard- entry through side of skull
 2. Transorbital- entry through eye socket
- The procedure netted occasional reduction in symptoms, but at great cost to social and cognitive functioning

METHODS

- Diffusion-weighted single-shot SE EPI; $b=0$ and ~ 800 s/mm² (Bammer 2001); 8 repeats; $\sim 2 \times 2 \times 2$ mm
- Healthy brains selected from existing database.
- Tractography using STT (Mori 1999; Basser 2000)
- ROIs drawn to replicate both lobotomy techniques.
- Analysis and visualization using mrDiffusion and Cinch software (Dougherty 2005, Akers 2006)

Which Pathways Were Cut?

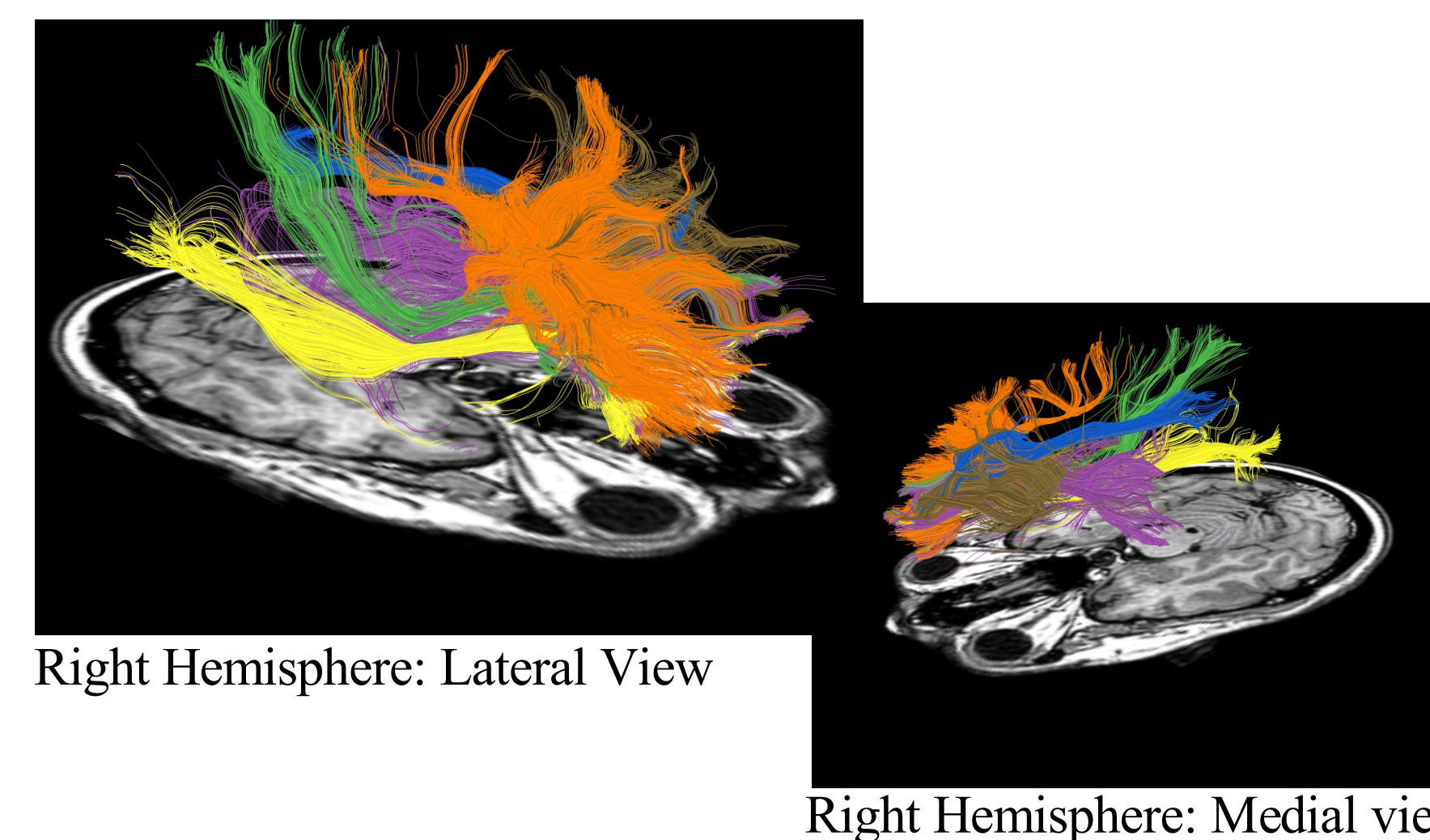
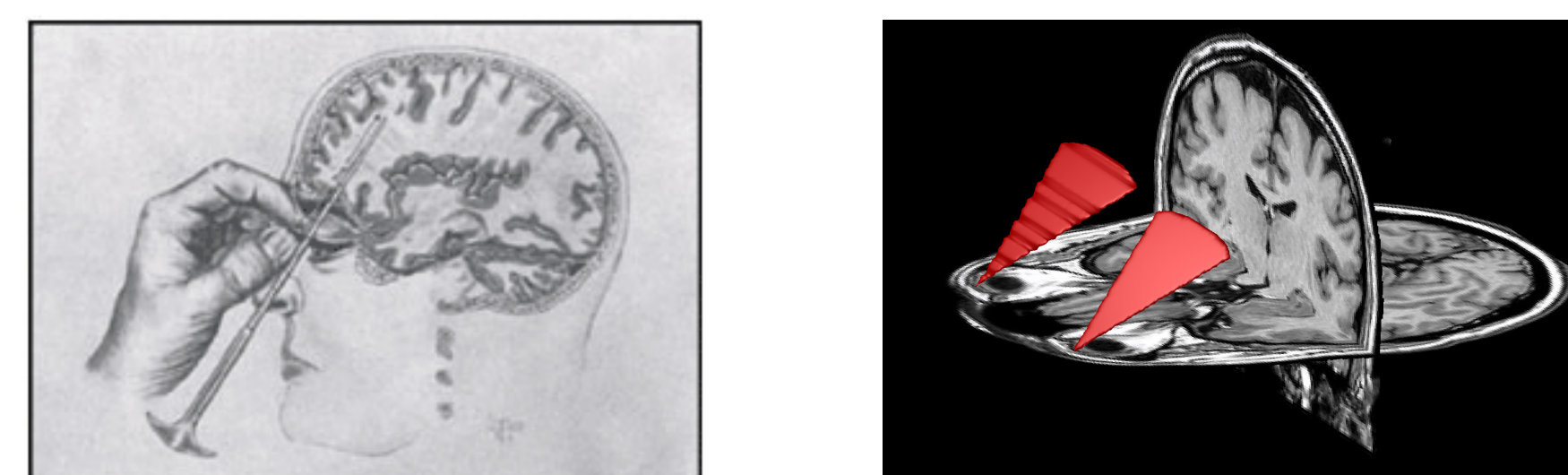
The Standard Method



Severed Tracts:

- 1. Cingulum
- 2. Superior longitudinal fasciculus
- 3. Inferior longitudinal fasciculus
- 4. Uncinate fasciculus
- 5. Anterior Thalamic Peduncle
- 6. Lateral Frontal fibers
- 7. Fronto-Callosal fibers

The Transorbital method



Severed Tracts:

- 1. Cingulum
- 2. Superior longitudinal fasciculus
- 3. Inferior longitudinal fasciculus
- 4. Anterior Thalamic Peduncle
- 5. Lateral Frontal fibers
- 6. Fronto-Callosal fibers

CONCLUSIONS

- Both methods effectively severed nearly all long-range anterior frontal connections
- The Transorbital method spared the Uncinate fasciculus and projections to Orbital cortex, but more severely damaged Fronto-lateral arcuate fibers
- Future work: Examine severed pathways and associated cortical functional reorganization and behavioral changes in lobotomy patients

Bibliography

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