Stereotactic surgery indications

1. Stereotactic biopsy indications

2. Stereotactic catheter placement

3. Stereotactic electrode placement

4. lesion generation

a) movement disorders: Parkinsonism, dystonia, hemiballismus

b) treatment of chronic pain

c) treatment of epilepsy (rarely used)

Stereotactic laser ablation

5. evacuation of intracerebral hemorrhage

a) using an Archimedes' screw device

b) with adjunctive urokinase or recombinant human tissue plasminogen activator

6. Stereotactic radiosurgery

7. to localize a lesion for open craniotomy (e.g. AVM, deep tumor)

a) using a ventricular catheter

b) using a blunt biopsy needle or introducer

c) systems using visible light laser beam for guidance

8. transoral biopsy of C2 (axis) vertebral body lesions

9. "experimental" or unconventional application

a) stereotactic clipping of aneurysms

b) stereotactic laser surgery

c) CNS transplantation: e.g. for Parkinsonism

d) foreign body removal

Stereotactic neurosurgical techniques are increasingly used to deliver biologics, such as cells and viruses, although standardized procedures are necessary to ensure consistency and reproducibility.

Olmsted et al. provided an instructional guide to help plan for complex image-guided trajectories; this may be of particular benefit to surgeons new to biologic trials and companies planning such trials.

They showed how nuclei can be segmented and multiple trajectories with multiple injection points can be created through a single or multiple burr hole(s) based on preoperative images. Screenshots similar to those shown in this article can be used for planning purposes and for quality control in clinical trials.

This method enables the precise definition of 3-D target structures, such as the putamen, and efficient planning trajectories for biologic injections. The technique is generalizable and largely independent of procedural format, and thus can be integrated with frame-based or frameless platforms to streamline reproducible therapeutic delivery.

They described an easy-to-use and generalizable protocol for intracerebral trajectory planning for stereotactic delivery of biologics. Although we highlight intracerebral stem cell delivery to the putamen using a frame-based stereotactic delivery system, similar strategies may be employed for different brain nuclei using different platforms. They anticipated this will inform future advanced and fully automated neurosurgical procedures to help unify the field and decrease inherent variability seen with manual trajectory planning [1].

1)
Olmsted ZT, Petersen EA, Pilitsis JG, Rahimi SY, Chen PR, Savitz SI, Laskowitz DT, Kolls BJ, Staudt MD. Toward Generalizable Trajectory Planning for Human Intracerebral Trials and Therapy. Stereotact Funct Neurosurg. 2022 Feb 7:1-10. doi: 10.1159/000521916. Epub ahead of print. PMID: 35130557.