# Frameless stereotactic biopsy

- Functional-guided frameless stereotactic biopsy of highly eloquent brain tumors
- Analysis of factors influencing diagnostic yield and target point error in robot-assisted stereotactic brain biopsy: a single-center experience
- Stereotactic radiosurgery for patients with brain metastases: current principles, expanding indications and opportunities for multidisciplinary care
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A frameless stereotactic biopsy is a medical procedure used to obtain a tissue sample from a specific area within the body, typically the brain, for diagnostic purposes. Unlike traditional stereotactic biopsy that use a rigid frame attached to the patient's head to precisely target the biopsy location, frameless stereotactic biopsies utilize advanced imaging technology for guidance, eliminating the need for a fixed frame.

Here's an overview of how the frameless stereotactic biopsy procedure is typically conducted:

Imaging: Advanced imaging techniques such as CT (computed tomography) or MRI (magnetic resonance imaging) scans are used to create detailed three-dimensional images of the target area in the body, often the brain.

Image Fusion: The imaging data is then fused or integrated with the patient's real-time anatomical position during the procedure. This integration helps the surgeon accurately navigate to the target site.

Navigation System: A navigation system, often based on infrared or laser technology, is used to track the position of surgical instruments and guide them to the predetermined coordinates within the body.

Biopsy Procedure: Once the surgeon has reached the targeted area, a biopsy needle is inserted through a small incision or burr hole in the skull to obtain a tissue sample. The navigation system assists in ensuring precision during this process.

Tissue Sample Analysis: The collected tissue sample is then sent to a pathology laboratory for detailed analysis to determine the nature of the lesion or abnormality.

Frameless stereotactic biopsies offer several advantages over traditional frame-based approaches. These advantages include greater flexibility in patient positioning, reduced invasiveness, and the ability to adapt to changes in the patient's position during the procedure.

It's important to note that the specific details of the procedure may vary depending on the medical institution, the equipment used, and the patient's condition. The choice between frameless and framed stereotactic biopsy depends on various factors, including the nature and location of the lesion, patient characteristics, and the surgeon's preference.

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Frameless stereotactic biopsy is used to direct the trajectory and biopsy site of target lesions.

Frameless stereotactic brain biopsy image guidance systems that use scalp fiducial markers offer more flexibility and patient comfort but provide less stability and accuracy during drilling and biopsy needle positioning.

Medtronic has developed advanced neuronavigation brain biopsy solutions, including both a frameless passive biopsy system and external Passive Biopsy system, which can be selected based on the clinical need and surgeon’s preference.

These image-guided biopsy systems help surgeons plan and perform faster and less-invasive brain biopsies by:

Eliminating visual obstructions and optimizing cranial access

Providing direct depth-stop calculation for accurate location of lesion

Confirming the biopsy location with biopsy needle navigation

Tailoring procedural flow for each surgeon’s preference

Navigus Frameless Passive Biopsy System

Frameless Biopsy System – A skull-mounted trajectory guide provides access through a small burr hole.

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We report on a novel intra-operative stimulating (IOS) probe that is integrated into a commercially available stereotactic biopsy needle with the rationale that stimulation of the intended biopsy site should predict functional tissue thus preventing inadvertent biopsy of eloquent tissue.

Methods: Patients undergoing brainstem biopsies for atypical lesions were offered the additional stimulation procedure. The IOS probe was used to deliver stimulation in an attempt to determine the proximity of eloquent tissue. Once the desired location of the biopsy needle was achieved, the IOS probe was inserted down the centre of the biopsy needle and the stimulus applied. If no action potential was recorded, biopsies from four quadrants of the lesion were taken. If however a compound action potential was recorded, a new target was selected.

Results: Nine patients had the biopsy and stimulation procedure performed. The median age was 36 months. A minimum of 8 samples were obtained from each patient. Biopsy material was adequate to obtain a diagnosis in all 9 patients. In 2 cases use of the device influenced the insertion trajectory or biopsy site. No patients experienced any complications directly attributable to either the biopsy procedure or application of the stimulation.

Use of the IOS probe for intraoperative stimulation of the intended brainstem biopsy site was found to

be safe and feasible. The addition of stimulation using the IOS probe can be done with minimal change in workflow [1].

## Case series

Dlaka et al. present et al. a novel robotic neuronavigation system, RONNA G4, used for precise preoperative planning and frameless neuronavigation, developed by a research group from the University of Zagreb and neurosurgeons from the University Hospital Dubrava, Zagreb, Croatia. The aim of the study is to provide a comprehensive error measurement analysis of the system used for brain biopsy.

Frameless stereotactic robot-assisted biopsies were performed on thirty-two consecutive patients. Post-operative CT and MRI scans were assessed to precisely measure and calculate target point error (TPE) and entry point error (EPE).

The application accuracy of the RONNA system for TPE was 1.95 ± 1.11 mm, while for EPE was 1.42 ± 0.74 mm. The total diagnostic yield was 96.87%. Linear regression showed statistical significance between the TPE and EPE and the angle of the trajectory on the bone.

The RONNA G4 robotic system is a precise and highly accurate autonomous neurosurgical assistant for performing frameless brain biopsies [2].

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Keywords: RONNA G4; computer-assisted The primary objective of this retrospective study was to evaluate the diagnostic yield and morbidity/mortality associated with frameless stereotactic neuronavigated intracranial biopsies with and without the use of fluorescein.

Patient cases from January 2007 to December 2017 were identified using the ICD-10 procedure code AAG00. Relevant clinical data, including histological diagnosis, were collected retrospectively from the electronic patient charts and independently reviewed by two authors.

111 biopsies obtained from 103 patients were identified. Of these, 109 biopsies yielded a diagnosis and resulted in a diagnostic yield of 98.2%. Fluorescein was used in 13 biopsies (11.7%). Twelve patients (10.8%) experienced postoperative complications, and the mortality attributed to the surgery was 1.8%. In 12.6% of cases, the biopsies showed inflammation or nonspecific reactive changes. No statistically significant differences were observed in diagnostic yield or number and severity of complications according to whether intraoperative histological examination was used or not.

Although direct comparisons between studies are difficult due to lack of consensus about the definition of diagnostic yield, the present study reports a similar diagnostic yield to other studies. Intraoperative histopathological analysis appeared to give little extra benefit [3].

### Frameless robotically targeted stereotactic brain biopsy

see Frameless robotically targeted stereotactic brain biopsy.

1)
Labuschagne J, Mutyaba D, Nel J, Casieri C. Use of intra-operative stimulation of brainstem lesion

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2)

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3)

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