





## Literature Reviews

# Achieving gross total resection in neurosurgery: a review of intraoperative techniques and their influence on surgical goals

Caroline Apra<sup>1 2 3 \*</sup>  , Joseph Synèse Bemora<sup>1 4 \*</sup>, Stéphane Palfi<sup>1 2 3</sup>

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## Highlights

- Complete tumor resection is predictive of local recurrence and survival
- Resection can be evaluated on contrast enhancement, nuclear imaging, surgical impression, metabolism, histology.
- Many intraoperative techniques help identify tumor limits based on optic, morphologic, nuclear, or molecular characteristics
- PET-MRI seems the most sensitive imaging tool to identify meningioma/glioma recurrence
- Reflection on surgical goals in terms of resection will guide the development of future intraoperative tools

## Abstract

### Introduction

The definition of complete resection in neurosurgery depends on tumor type, surgical aims, and postoperative investigations, directly guiding the choice of intraoperative tools.

### Areas covered

Most common tumor types present challenges in achieving complete resection due to infiltrative nature and anatomical constraints. The development of adjuvant treatments has altered the balance between oncological aims and surgical risks. We review local recurrence associated with incomplete resection based on different definitions and emphasize the importance of achieving maximal safe resection in all tumor types. Intraoperative techniques that aid surgeons in identifying tumor boundaries are used in practice and in preclinical or clinical research settings. They encompass both conservative and invasive techniques. Among them, morphological tools include imaging modalities such as intraoperative MRI, ultrasound, and optical coherence tomography. Fluorescence-guided surgery, mainly using 5-aminolevulinic acid, enhances gross total resection in glioblastomas. Nuclear methods, including PET-probes, provide tumor detection based on beta or gamma emission after a radiotracer injection. Mass spectrometry and spectroscopy-based methods offer molecular insights.

### Expert opinion

The adoption of these techniques depends on their relevance, effectiveness, and feasibility. With the emergence of PET-imaging as a recurrence benchmark, PET-probes raise particular interest among those tools. While they all provide valuable insights, their clinical benefits need further evaluation.

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\* Those authors contributed equally to this work

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