Selective Amygdalohippocampectomy

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KEYWORDS

• Amygdalohippocampectomy • Epilepsy • Mesial temporal sclerosis • Subtemporal • Temporal lobectomy • Transcortical • Transsylvian

KEY POINTS

- Selective amygdalohippocampectomy effectively reduces seizure severity and frequency in patients with mesial temporal epilepsy.
- Selective procedures seem to be as effective as anterior temporal lobectomy in patients whose disease is limited to the mesial temporal structures.
- Although the evidence is inconclusive, it suggests that selective amygdalohippocampectomy may preserve neurocognitive function better than anterior temporal lobectomy.
- Multiple approaches are available to access the mesial temporal structures.
- There is no definitive evidence for the superiority of a particular approach in terms of seizure control or neurocognitive outcome.

INTRODUCTION

Eliminating seizures while preserving a patient's neurologic function is the defining goal of all epilepsy surgery. Epilepsy of the temporal lobe, and specifically epilepsy localized to the mesial temporal structures, is by far the most common focal epilepsy in adults and is among the most common focal epilepsies afflicting children.[1] Mesial temporal lobe epilepsy (MTLE) is also among the least likely type of epilepsy to be adequately controlled with medical treatment alone.[2] A prospective randomized controlled trial published by Wiebe and colleagues[3] demonstrated that anterior temporal lobectomy (ATL) with resection of the mesial temporal structures is superior to medical management for drug-resistant MTLE. Engel and colleagues[4] confirmed their findings in 2012 in a similarly methodologically sound study. Such resection offers increased quality of life to patients[5] and has been found to be cost-effective in both children and adults.[6–8]

However, anteromedial temporal lobe resection entails resection of the anterior portion of the temporal lobe, which may not be implicated in seizure production in isolated mesial temporal disease. Driven by a desire to preserve structures outside of the epileptogenic zone, investigators have developed so-called selective procedures. Specifically, selective amygdalohippocampectomy (SAHC) has been described as an alternative to target only the mesial temporal structures while preserving the lateral neocortex, temporal pole, and temporal white matter tracts.[9–11] No incontrovertible evidence exists, but selective procedures should theoretically reduce the morbidity of epilepsy surgery.[12]

Although the terms *ATL* and *SAHC* are commonly used for this procedure, both terms are somewhat misleading. As described by most investigators, ATL involves resection of not only the anterior portion of the temporal lobe but also most of the hippocampus, amygdala, and parahippocampal structures. Similarly, SAHC involves

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resection of the bulk of the hippocampus, amygdala, and parahippocampal structures.

PATIENT EVALUATION OVERVIEW

Indications

SAHC is reserved for patients with disabling, medically intractable seizures that originate unilaterally in mesial temporal structures (**Box 1**).[4,13–15] The American Academy of Neurology recommends that patients with drug-resistant MTLE resulting in disabling complex partial seizures be referred for surgery[5] because of a single randomized controlled trial and a further 24 observational studies.[16] The International League Against Epilepsy (ILAE) defined drug resistance as failure of 2 tolerated, appropriately chosen, and used antiepileptic drug schedules.[15]

Preoperative Evaluation

There are 2 key factors in selecting a patient for SAHC. First, localization of the epileptogenic zone to the mesial temporal structures is paramount. Second, assessment of the risk for function decline due to surgery is no less important. A full discussion of seizure localization and risk assessment is beyond the scope of this article, but most investigators[2,16–20] agree that a thorough neurologic examination, clear understanding of the seizure semiology, interictal electroencephalographic (EEG) evaluation, high-resolution magnetic resonance imaging (MRI) of the brain, and neuropsychological evaluation represent a minimum presurgical investigation (**Box 2**). Indeed, the ILAE Subcommission for Pediatric Epilepsy Surgery concluded that interictal EEG, neuropsychological assessment, and high-resolution MRI were mandatory.[19]

Box 1
Patient selection for SAHC

Indications

- Disabling, drug-resistant, mesial temporal lobe epilepsy

Contraindications

- Evidence that patients will have neurocognitive decline with surgery, which would outweigh the benefit of seizure control
- Multifocal onset of seizures or bilateral independent mesial temporal lobe onset
- Patients' general medical inability to tolerate surgery

Abbreviations: SAHC, selective amygdalohippocampectomy.

Box 2
Presurgical epilepsy evaluation

Mandatory studies

- Review of seizure history, semiology, and symptoms
- Neuropsychological evaluation
- Video scalp EEG monitoring
- High-resolution MRI with coronal projections

Complementary studies

- PET with fludeoxyglucose F 18
- Ictal single-photon emission computed tomography
- Magnetoencephalography
- Intracarotid amobarbital testing (Wada test)
- Selective posterior cerebral artery amobarbital testing (selective Wada test)
- Intracranial EEG electrode monitoring
- Functional MRI
- Diffusion tensor imaging

Abbreviations: EEG, electroencephalography; MRI, magnetic resonance imaging; PET, positron emission tomography.

Complementary evaluation techniques can also be of great value. However, a well-designed systematic review by Burch and colleagues[21] of noninvasive presurgical evaluation other than EEG and MRI identified no randomized trials or cohort studies, and minimal high-quality evidence of effectiveness in any individual complementary study. The investigators opined that each of the complementary techniques may be useful in the context of a comprehensive evaluation and recommended thorough discussion of individual cases in a multidisciplinary conference to provide an optimal surgical plan. As elegantly described by Spencer and Burchiel,[20] the selection of patients should depend on converging lines of evidence.

Some investigators advocate reserving SAHC for cases when imaging abnormalities are present on MRI.[13] Other surgeons argue that if there is reasonable confidence of a mesial temporal seizure origin, SAHC may be offered with the option of completing resection of the neocortical structures at a later date if necessary. ATL with resection of the medial structures may be more appropriate if there are findings consistent with neocortical sources.[22] The senior author's current practice is to stereotactically implant depth electrodes into the hippocampus and amygdala bilaterally in MRI-negative