Epilepsy & Behavior xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Epilepsy & Behavior

journal homepage: www.elsevier.com/locate/yebeh

Visual field defects following different resective procedures for mesiotemporal lobe epilepsy

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ARTICLE INFO

Article history:
Received 14 June 2017
Revised 15 August 2017
Accepted 26 August 2017
Available online xxxx

Keywords:
Visual field defect
Driving
Mesiotemporal lobe epilepsy
Standard anterior temporal lobectomy
Keyhole resection
Selective amygdalohippocampectomy

ABSTRACT

Introduction: One of the most common side effects of mesiotemporal lobe resection in patients with medically intractable epilepsy are visual field defects (VFD). While peripheral defects usually remain unnoticed by patients, extended VFD influence daily life activities and can, in particular, affect driving regulations. This study had been designed to evaluate frequency and extent of VFD following different surgical approaches to the mesiotemporal area with respect to the ability to drive.

Materials and methods: This study comprises a consecutive series of 366 patients operated at the Epilepsy Center in Freiburg for intractable mesiotemporal lobe epilepsy from 1998 to 2016. The following procedures were performed: standard anterior temporal lobectomy (ATL: n = 134; 37%), anterior temporal or keyhole resection (KH: n = 53; 15%), and selective amygdalohippocampectomy via the transsylvian (tsAHE: n = 145; 40%) and the subtemporal (ssAHE: n = 34; 9%) approach. Frequency and extent of postoperative VFD were evaluated in relation to different surgical procedures. According to the German driving guidelines, postoperative VFD were classified as driving-relevant VFD with the involvement of absolute, homonymous central scotoma within 20° and driving-irrelevant VFD with either none or exclusively minor VFD sparing the center.

Results: Postoperative visual field examinations were available in 276 of 366 cases. Postoperative VFD were observed in 202 of 276 patients (73%) and were found to be driving-relevant in 133 of 276 patients (48%), whereas 69 patients (25%) showed VFD irrelevant for driving. Visual field defects were significantly less likely following ssAHE compared with other temporal resections, and if present, they were less frequently driving-relevant ($p < 0.05$), irrespective of the side of surgery.

Conclusion: Subtemporal sAHE (ssAHE) caused significantly less frequently and less severely driving-relevant VFD compared with all other approaches to the temporal lobe, irrespective of the side of surgery.

1. Introduction

Surgery has proven to be a promising option for the treatment of pharmacoresistant mesiotemporal lobe epilepsy [1,2] with the potential to control seizures and improve quality of life [1]. Most patients' preoperative expectations include far more than seizure freedom [3]. Particularly for younger patients, the desire to get a driving license reflecting social independence plays an important role in the decision-making process to undergo surgery [3–5].

Although neurological impairment due to temporal lobe resections remains rare, visual field defects (VFD) have been found to be a frequent sequela [6,7] resulting from the interference of the resection area with the anterior part of Meyer's loop [8–10]. The great anatomical variability of Meyer's loop accounts [10,11] for the high range of reported incidence of VFD ranging from 0 to 100% [12–15]. Visual field defects are responsible for precluding up to 50% of patients from driving, despite postoperative seizure freedom [4,16,17]. Yet, as driving constitutes one of the key goals and motivations of patients to undergo surgery, the preservation of the visual field is of paramount importance [18,19]. To get a driving license for passenger cars in Germany, a binocular vision field of 120° horizontal diameter and intact central

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http://dx.doi.org/10.1016/j.yebeh.2017.08.037
1525-5050/

20° without homonymous absolute scotomata is necessary. For heavy-goods vehicles, the central 30° of the visual field is required to be intact.

Different surgical approaches to the temporal lobe have been developed ranging from extensive resections of the temporal lobe [20–23] to a selective removal of temporomesial structures [24–27]. Yet, the superiority of more selective procedures in sparing visual function has remained a matter of controversial debate. Therefore, the aim of this study was to analyze the incidence and extent of VFD in relation to four different surgical resective approaches to the temporal lobe in a large consecutive series. We hypothesized that more circumscribed resections would cause less frequently and only minor VFD irrelevant for driving ability.

2. Materials and methods

2.1. Patient population and data collection

This retrospective study comprises 366 consecutive patients operated for pharmacoresistant temporal lobe epilepsy at the Epilepsy Center Freiburg between 1998 and 2016. Only patients who underwent one of the four standard resective procedures as mentioned below were included. Patients with minor and individually tailored resections or resections exceeding standard procedures were excluded from our analyses. In 276 of those patients, pre- and postoperative visual field examinations were available, whereas in 90 patients, ophthalmological examination was incomplete, e.g., for incompliance due to young age, retardation, or lost follow-up. In addition, presurgical evaluation included detailed medical history of seizure semiology, neurological examination, high resolution magnetic resonance imaging (MRI), and continuous noninvasive or invasive EEG monitoring according to a standardized protocol as described previously [28–30].

2.2. Surgical procedures

The following surgical procedures were performed: standard anterior temporal lobectomy (ATL) [20,31–33], keyhole resection (KH) [23], and selective amygdalohippocampectomy via the transsylvian (tsAHE) [24,27] or the subtemporal (ssAHE) [26] approach. Resection type depended on the location and extent of the epileptogenic focus according to the consent of the interdisciplinary epilepsy conference. The different surgical approaches are illustrated in Fig. 1. Details of surgical approaches have been published elsewhere [28].

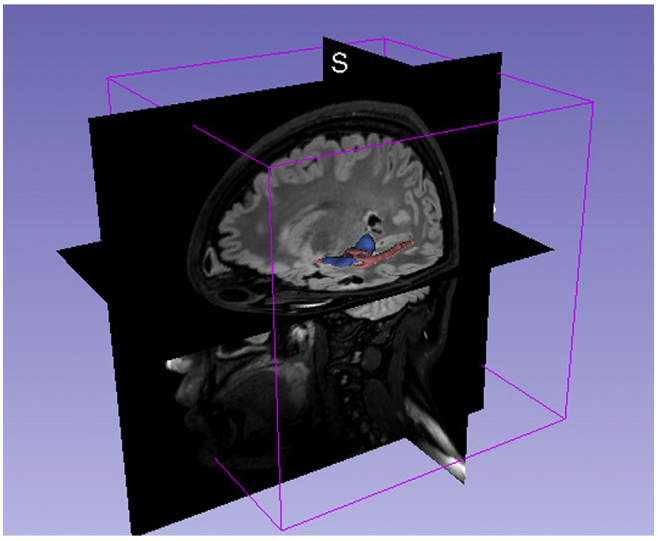

Fig. 2. The course of the Meyer's Loop in 3D projection (red) in relation to the hippocampus (blue) in a specific patient. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

2.3. Ophthalmologic examination

The course of Meyer's Loop is visualized in Fig. 2. Visual fields were examined preoperatively as well as 3 to 6 months postoperatively. Only patients examined by kinetic Goldmann perimetry or static perimetry with a minimum of 75° were included. If both kinetic and static perimetries were available, kinetic Goldmann perimetry was preferred. Kinetic Goldmann perimetry was performed in 179 patients (Haag-Streit Goldmann 940, Koenitz Switzerland). In 97 patients, visual fields were measured using static perimetry (OCULUS Twinfield®; program 07: 0–90° or Octopus® 500; program 07: 75°) [34]. Analyses within this postoperative period were considered to be representative [14]. In the following, the term VFD refers to absolute, homonymous scotoma in binocular visual field examination.

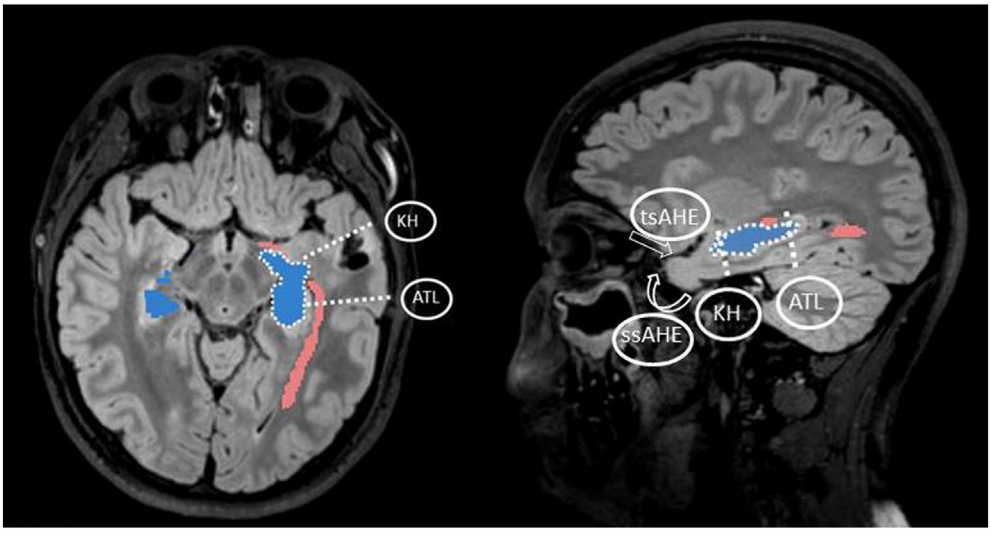

Fig. 1. MRI illustration of the visual pathway (red) in relation to the hippocampus (blue) in a specific patient and schematic representation of resection borders following different resective procedures in the temporal lobe (dotted line). Standard anterior temporal lobectomy (ATL), keyhole resection (KH), transsylvian selective amygdalohippocampectomy (tsAHE), and subtemporal selective amygdalohippocampectomy (ssAHE). The flash indicates the surgical approach in sAHE. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Please cite this article as: Schmeiser B, et al, Visual field defects following different resective procedures for mesiotemporal lobe epilepsy, Epilepsy Behav (2017), http://dx.doi.org/10.1016/j.yebeh.2017.08.037