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Functional hemispherectomy is safe and effective in adult patients with epilepsy

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ABSTRACT

Introduction: Functional hemispherectomy (FH) is a well-established therapeutic option for children with epilepsy with parenchymal damage confined to one hemisphere, yet its application in adults remains rare. The intention of our study was to investigate postoperative clinical and epileptological outcome in adults who received FH for intractable epilepsy.
Materials and methods: We retrospectively analyzed 12 adult patients (18–56 years) with intractable epilepsy due to unihemispheric pathology. All patients underwent FH. Postoperative neurological and cognitive outcome as well as seizure status were evaluated with a mean follow-up period of 4.9 years.
Results: Ten patients (83%) were seizure-free (Engel I), and two (17%) had recurrent seizures at last follow-up. Apart from one patient requiring operative revision for bone flap infection, no perioperative morbidity or mortality occurred. Postoperative functional assessment revealed deterioration of motor function in 7 patients, whereas 5 remained unchanged. Language was unchanged in 8 patients. The absence of background slowing in preoperative electroencephalogram (EEG) as well as ictal and interictal EEG patterns located ipsilateral to the side of surgery was associated with favorable seizure outcome.
Conclusion: Favorable seizure control and acceptable functional outcome can be achieved by FH in adults with intractable epilepsy. The risk of postoperative deficits is moderate and even older patients are able to manage postoperative motor impairment. Therefore, FH should be considered in case of unihemispheric lesions also in adults.

1. Introduction

Functional hemispherectomy (FH) constitutes a surgical procedure indicated in patients with severe pharmacoresistant unihemispheric epilepsy [1,2]. This technique is classically applied in children with severe and often progressive parenchymal damage confined to one hemisphere leading to catastrophic epilepsy with additional neurological deficits including contralateral spastic hemiparesis and cognitive impairment. However, FH has not frequently been applied in adults, although favorable results have been reported [3–6]. Therefore, this study aimed to investigate clinical and epileptological outcome of adults who underwent FH for intractable epilepsy.

2. Materials and methods

2.1. Patients and preoperative evaluation

We retrospectively analyzed 12 adult patients, with ages ranging from 18 to 56 years. All patients underwent FH at the Epilepsy Center, University Hospital of Freiburg, between 1997 and 2016 for medically intractable epilepsy (Fig. 1). Five of them had been included in prior reports [4,7]. Preoperative clinical evaluation was performed according to a standardized protocol comprising medical history, seizure semiology, detailed neurological examination, and neuropsychological assessment including selective attention (d2 concentration endurance test) [8], verbal learning and memory (VLMT: Verbaler Lern- und Merkfähigkeitstest, a German version of the Auditory Verbal Learning Test of Rey) [9], as well as nonverbal learning and memory (DCS-R: Diagnosticum für Cerebralschaedigung) [10,11]. Impairment of hand function is referred to as mild in case of remaining ability for daily activities, whereas it is referred to as considerable if there is noticeable impairment with respect to daily activities.

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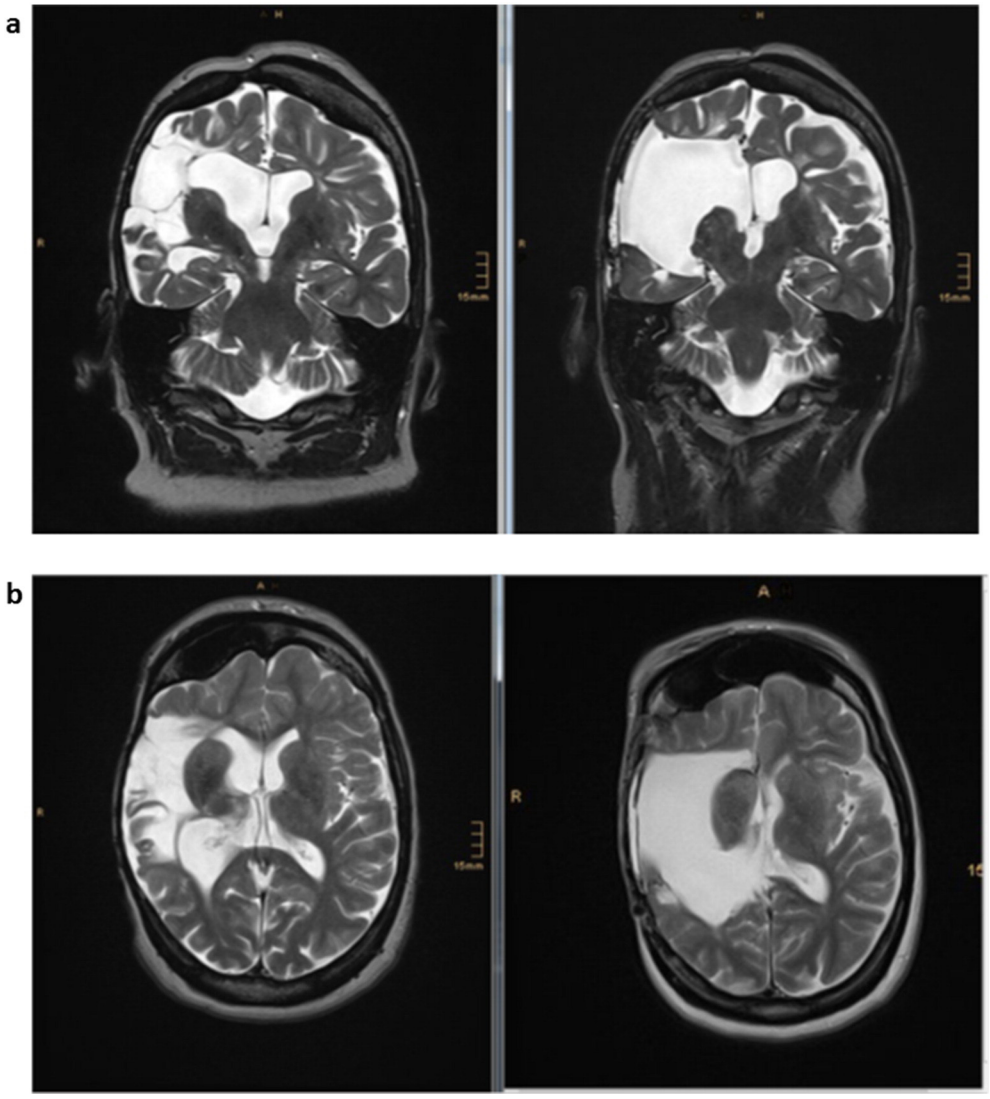

Fig. 1. T2 weighted MRI of one patient before (a) and after (b) functional hemispherectomy.

Preoperative seizure types were classified according to the International League Against Epilepsy (ILAE) classification published in 2017 by Fisher [12] and Scheffer et al. [13]. In this classification, epilepsy is assigned to seizures with (1) focal onset, (2) generalized onset, (3) and unknown onset with subcategories of motor and nonmotor semiology.

Long-term video-electroencephalogram (EEG) monitoring was performed to record typical seizures and to evaluate semiology, ictal onset zone, and interictal epileptiform activity. We grouped the patients according to postoperative seizure status: 1) patients were immediately completely seizure-free following surgery and remained as such over the whole postoperative follow-up period, 2) patients who gained seizure freedom initially after surgery but experienced recurrent seizures in the course of follow-up, 3) patients who suffered from recurrent seizures immediately after surgery but became completely seizure-free 2 years following surgery, and 4) patients whose seizure status was not improved by surgical treatment.

The extent of the underlying epileptogenic lesion as well as contralateral pathologies was evaluated by 1.5 or 3 (available since 2004) Tesla magnetic resonance imaging (MRI). Magnetic resonance imaging included T1, T2, and fluid-attenuated inversion recovery (FLAIR) sequences. If necessary, functional MRI or WADA testing was added.

Based on these findings, surgery was individually indicated and planned in our interdisciplinary epilepsy conference considering potential neurological deterioration. All resections were performed by one of the authors (J.Z.) using the perisylvian or the transsylvian–transventricular approach (Fig. 2). The transsylvian–transventricular approach was only used in patients with pronounced hemiatrophy, whereas the perisylvian approach was performed in patients with a significant mass of the affected hemisphere. Histopathological specimens were analyzed by a neuropathologist according to standardized classification [14–16].

2.2. Postoperative evaluation

Postoperative neurological, epileptological, and cognitive status as well as EEG were evaluated at 3 months after surgery and every year thereafter. Seizure outcome was classified as described by Engel et al. [17]: (I) free of disabling seizures, whereas Ia refers to completely seizure-free patients since surgery, (II) rare disabling seizures, (III) worthwhile improvement, and (IV) no worthwhile improvement.

Neurological assessment comprised evaluation of motor function, especially the presence and severity of hemiparesis including ability to walk and fine finger movements. Visual fields were evaluated by Goldmann perimetry. Cognitive performance was assessed by neuropsychological evaluation according to the preoperative protocol. Postoperative interictal EEG was carried out to record basic background activity, focal slowing, as well as interictal epileptiform discharges ipsilateral or contralateral to the operated hemisphere. Postoperative quality of life was