Epilepsy Research (2009) **83**, 235—242

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

Stereotactic radiofrequency amygdalohippocampectomy for the treatment of mesial temporal lobe epilepsy: Correlation of MRI with clinical seizure outcome

Hana Malikova[a,*], Zdenek Vojtech[b], Roman Liscak[c], Tomas Prochazka[b], Josef Vymazal[a], Vilibald Vladyka[c], Jiri Keller[a], Miroslav Kalina[b]

[a] *Department of Radiology, Hospital Na Homolce, Roentgenova 2, 15000 Prague 5, Czech Republic*
[b] *Department of Neurology, Hospital Na Homolce, Roentgenova 2, 15000 Prague 5, Czech Republic*
[c] *Department of Stereotactic and Radiation Neurosurgery, Hospital Na Homolce, Roentgenova 2, 15000 Prague 5, Czech Republic*

Received 31 March 2008; received in revised form 6 September 2008; accepted 19 November 2008
Available online 9 January 2009

KEYWORDS
Temporal lobe epilepsy;
Stereotactic surgery;
Volumetry;
MRI

Summary Stereotactic radiofrequency amygdalohippocampectomy (AHE) has been reintroduced as an alternative treatment of mesial temporal lobe epilepsy. The aim of this study was to describe MRI changes after stereotactic AHE and to correlate the hippocampal and amygdalar volumes reduction with the clinical seizure outcome.

Eighteen patients after stereotactic AHE were included. Volumetry was calculated from preoperative MRI and from MRI obtained 1 year after the operation. The clinical outcome was examined 1 and 2 years after the treatment.

Hippocampal volume decreased by 54 ± 19%, and amygdalar volume decreased by 49 ± 18%. One year after the procedure, 13 (72%) patients were classified as Engel's Class I (9 as Class IA), 4 (22%) patients as Class II and 1 (6%) patient as Class III. Two years after the operation, 14 patients (82%) were classified as Class I (7 as Class IA) and 3 patients (18%) as Class II. We found 3 surgical complications after the procedure: one small subdural hematoma, and twice a small electrode tip left in operation field (these patients were excluded from the study). In 3 patients, temporary meningeal syndrome developed.

Results of radiofrequency AHE are promising. The volume reduction of target structures after AHE is significantly related to the clinical outcome.

* Corresponding author. Tel.: +420 257 272 500.
E-mail address: hana.malikova@homolka.cz (H. Malikova).

0920-1211/$ — see front matter © 2008 Elsevier B.V. All rights reserved.
doi:10.1016/j.eplepsyres.2008.11.013

Introduction

Temporal lobe epilepsy (TLE) is classified as a localization-related epileptic syndrome (Commission on Classification and Terminology of the ILAE, 1989), and is usually divided into two categories: mesial temporal epilepsy (MTLE) and lateral temporal neocortical epilepsy (NTLE). However, there is a marked overlap in etiologies, symptomatology and treatment (Shorvon, 2004). In the absence of MRI detectable pathology, it is difficult to non-invasively distinguish MTLE from NTLE (Madhavan and Kuzniecky, 2007). The most common substrate for MTLE is mesial temporal sclerosis (MTS). MTLE with MTS (Engel, 1996; Sadler, 2006) is the most surgically amenable epilepsy diagnosis and the results of epilepsy surgery are clearly superior to prolonged medical therapy (Wiebe et al., 2001; Spencer et al., 2003), with a seizure-free outcome in approximately 70% of cases (McIntosh et al., 2001; Spencer, 2002; Wieser et al., 2003). In a comparable population treated conservatively from a tertiary center only 11% of patients with MTS was seizure-free in the past year (Dlugos, 2001).

Nowadays, the most important imaging method in evaluation of MTLE is MRI. MTS causes increased T2 weighted signals in mesial temporal lobe structures and decreased size of the hippocampal formation (Fig. 1) (Babb et al., 1984). Analysis of the resected tissue shows neuronal loss, gliosis and also neuronal reorganization (Babb et al., 1984; Babb and Brown, 1987; Spencer and Inserni, 1991). Lencz et al. (1992) showed that neuronal loss from the resected hippocampus correlates significantly with decreased hippocampal volume on MRI. Hippocampal atrophy is also correlated with seizure control after surgery (Jack et al., 1992; Kuzniecky et al., 1993).

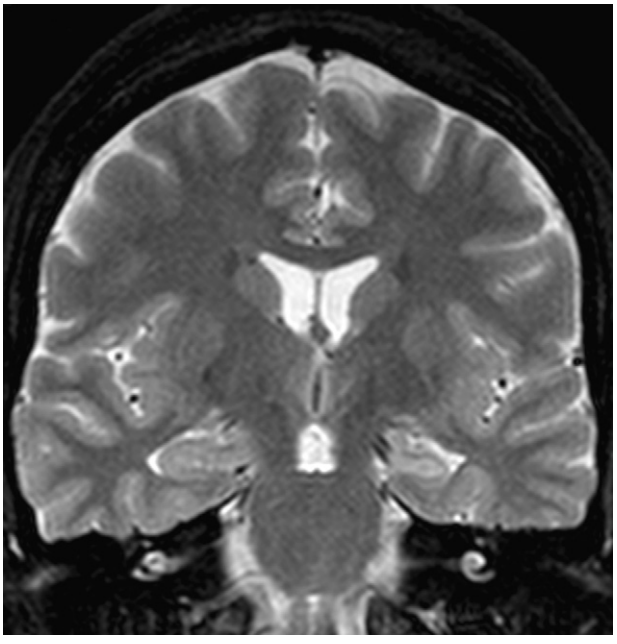

Figure 1 Left MTS: left hippocampus is smaller than right hippocampus and has higher signal on T2WI (TSE T2WI coronal plane).

Anterior temporal lobectomy (ATL) or selective amygdalohippocampectomy (AHE) are the most common surgery for intractable MTLE. Standard ATL usually involves resection of amygdala, hippocampus and parahippocampal gyrus, with a resection line in the temporal neocortex extending 3—3.5 cm from the temporal tip (Spencer and Inserni, 1991). AHE is a selective removal of the medial structure of temporal lobe with sparing lateral neocortex (Wieser and Yasargil, 1982; Wurm et al., 2000; Wieser et al., 2003).

Selective AHE was introduced by Niemeyer (1958). The goal of this procedure is to remove the medial structures of the temporal lobe: amygdala, hippocampus and parahippocampus, while minimizing neocortical resection. Several studies stated comparable seizure control after ATL and after selective AHE (Spencer and Inserni, 1991; Yasargil et al., 1993; Engel et al., 1993; Olivier et al., 1994). Other studies revealed better postoperative neuropsychological results after limited resections compared with standard ATL (Spencer and Inserni, 1991; Yasargil et al., 1993; Clusmann et al., 2002; Lacruz et al., 2004; Hamberger and Drake, 2006). There is, however, evidence that due to collateral damage, selective surgery can be less selective than suggested (Helmstaedter et al., 2008).

Despite the high success rate of the standard epilepsy surgery, novel surgical therapies for MTLE have been evaluated (Polkey, 2003; McKhann, 2004). Efforts to perform stereotactic epilepsy surgery have been made since the fifties. However, the methodology was limited by the inability of pre-operative evaluations to visualize target structures. The operation was at first based on stereotactic coordinates from anatomical atlas and ventriculography. Therefore, amygdalohippocampal complex (AHC) was often missed. Moreover, due to insufficient diagnostic work-up some cases were misdiagnosed. As a consequence, the clinical outcome was not satisfactory in the pioneer days of stereotactic epilepsy surgery (Talairach et al., 1974; Vladyka, 1978).

Stereotactic radiofrequency AHE, as an alternative therapy of MTLE, was reintroduced in a modern setup by the London—Ontario group (Parrent and Blume, 1999). However, the clinical outcomes were inferior to open surgical ATL (Parrent and Blume, 1999). In our hospital, stereotactic radiofrequency AHE has been used since 2004. First promising results have been already published (Kalina et al., 2007).

The aim of this study was to describe MRI changes after stereotactic AHE, to analyze the reduction of hippocampal and amygdalar volumes and its relation to the clinical outcome with respect to seizures.

Materials and methods

We retrospectively reviewed all medical records and MRI evaluations in patients, who underwent stereotactic radiofrequency AHE during the period 2004—2006.

Patient selection

Twenty consecutive patients with intractable MTLE underwent stereotactic AHE at the Stereotactic and Radiation Neurosurgery Department of Na Homolce Hospital, Prague, Czech Republic. Preoperatively, all patients were evaluated according to the standard protocol (MRI, FDG-PET, video-scalp EEG, Wada test using metho-