Surgery for TLE has become a safe and successful treatment option for patients suffering from drug-resistant seizures. The outcome of temporal resections is a function of presurgical selection criteria, topography, and extent of resection. Various surgical procedures render between 60% and 90% of the patients seizure free. Definition of the clinical syndrome of mesial temporal lobe epilepsy (TLE) has allowed surgeons to select patients in whom the epileptogenic zone is confined to the medial structures of the temporal lobe. Selective removal of these structures is equally effective in controlling seizures and, unlike standard temporal lobectomy, may avoid postoperative memory deficits. The appropriate surgical approach and the extent of tissue removal in selective resections is still a matter of debate. Results of different microsurgical approaches are difficult to compare because of the anatomical complexity of the surgical target lying hidden in the basal portion of the skull. Thus, evaluation of outcome requires postoperative morphometric review of the surgical lesion. Volumetric analyses of MR images obtained after SA indicates that the amount of resected tissue varies considerably. According to reports from two separate institutions, the resected tissue measured from 2.1 to 17.7 cm³ or was 5.7 to 23.6% of the volume of the temporal lobe. Based on the results of electrophysiological studies, one can conclude that not only the volume of resected tissue but

**Object.** The concept of selective amygdalohippocampectomy is based on pathophysiological insights into the epileptogenicity of the hippocampal region and the definition of the clinical syndrome of mesial temporal lobe epilepsy (TLE). High-resolution magnetic resonance (MR) imaging allows correlation of the site of histologically conspicuous tissue with anatomical structure. The highly variable sulcal pattern of the basal temporal lobe, however, definitely complicates the morphometric analysis of histomorphologically defined subdivisions of the hippocampal region. The goal of this study was to define individual variations in the sulcal anatomy on the basis of preoperative MR images obtained in patients suffering from TLE.

**Methods.** The authors analyzed coronal MR images obtained in 50 patients for the presence of and intrinsic relationships among the rhinal, collateral, and occipitotemporal sulci. The surface relief of consecutive sections of 100 temporal lobes was graphically outlined and the resulting maps were used for visual analysis. The sulci were characterized by measurement of their depth, distance to the temporal horn, and laterality. The anatomical measurements and frequencies of sulcal patterns were assessed for statistical correlation with patients’ histories and the lateralization of the seizure focus.

**Conclusions.** Statistical assessment shows that patient sex is a significant factor in sulcal patterns. Anatomical measurements are significantly decreased on the side of the seizure origin, which relates to loss of white matter, a known morphological abnormality associated with TLE. Magnetic resonance imaging allows for accurate preoperative knowledge of individual sulcal patterns and facilitates intraoperative orientation to anatomical landmarks.
Sulcal anatomy of the temporal lobe

The sulci of the mesiobasal temporal lobe display important landmarks delineating the ERC and, thus, they function as topographic markers for the lateral limit of the microsurgical resection in transsylvian SA (Fig. 1). Cadaveric studies of temporal lobe anatomy have documented highly variable patterns of these sulci; therefore, individual variation as topographic markers for the lateral limit of the mesiobasal subcompartments, which demonstrates that removal of the ERC is even more important for outcome than hippocampal resection.7

The ERC is a periarchicortical region in the ventromedial aspect of the temporal lobe that functions physiologically as a gatekeeper for sensory input to the hippocampus and plays a major role in memory processing.25,53 Anatomical studies have reported that the human ERC has a surface area of 720 mm².47 The median volume of the ERC in healthy volunteers measures 1247 mm³ on the right side and 1215 mm³ on the left side. In patients with epilepsy there is a reduction in the ERC volume, which is more severe on the side ipsilateral to the seizure focus.9 Pathological findings revealed neuronal cell loss preferentially in Layer III of the ERC in patients with TLE.13

The sulci of the mesiobasal temporal lobe display important landmarks delineating the ERC and, thus, they function as topographic markers for the lateral limit of the microsurgical resection in transsylvian SA (Fig. 1). Cadaveric studies of temporal lobe anatomy have documented highly variable patterns of these sulci; hence, individual variations in sulcal anatomy imply a certain variability of the lateral extent of the ERC.24 Therefore, a meticulous analysis of individual anatomy performed using preoperative MR images might improve the accuracy of SA. Furthermore, technical variations of the transsylvian approach for SA are sought that warrant precise resection of the PHG with minimal injury to the fusiform gyrus and the rest of the temporal lobe.39,42,55 To date, however, clinical proof of the superiority of alternative approaches is missing.

The purpose of this study was to investigate the temporal-sulcal patterns in vivo and to define the course of the RS, CS, and OTS, their depths and lateralities, and their distances from and relationships to the ventricle wall.

Clinical Material and Methods

Patient Population

The study included candidates scheduled for epilepsy surgery who suffered from medically refractory TLE. Fifty consecutive patients whose MR images displayed no pathological conditions other than MTS were selected for the study group.22 The patients’ histories included febrile seizures, meningitis or meningoencephalitis, perinatal asphyxia, prematurity, and head trauma (Table 1). The patient population consisted of 28 male and 22 female patients aged 3 to 48 years (mean age 32.8 years). The duration of epilepsy ranged between 2.5 and 43 years (mean duration 23.3 years). The patients were admitted to our institution between 1996 and 1999 for presurgical evaluation according to the protocol of the Epilepsy Monitoring Unit at the University Clinic for Neurology at the Vienna General Hospital.3 Patients with typical clinical signs of seizure, anterior temporal spikes on interictal electroencephalography, and radiological signs of MTS received the diagnosis of mesial TLE (43 patients). Patients who displayed typical signs of seizure and temporal spikes but no signs of MTS on MR images received the diagnosis of nonlesional TLE (seven patients). Unilateral MTS was diagnosed on the basis of findings on routine MR images obtained in 42 of the 50 patients (see following section). In patients with nonlesional TLE (seven patients), bilateral MTS (one patient), or those in whom noninvasive studies were inconclusive (one patient), invasive monitoring was performed to identify the lateralization of the seizure origin. Twenty-five patients suffered from left TLE and 23 from right TLE; in two patients invasive electroencephalography did not yield a unilateral seizure focus. Informed consent was obtained from all patients or guardians.

Protocol for MR Imaging

During presurgical evaluation MR images were routinely performed using a 1.5-tesla magnet (Philips gyrosan; Philips Medical Systems, Amsterdam, The Netherlands) according to a dedicated protocol for patients with epilep-
The protocol included transverse FLAIR and T2-weighted gradient-echo sequences to exclude extratemporal pathological conditions and hemorrhagic residues, respectively. The specific protocol for MTS cases consisted of paracoronal sections located perpendicular to the hippocampal formation and having a slice thickness of 2 to 4 mm, a 10% gap, high-resolution T2-weighted turbo spin-echo (TR 2500–3000 msec, TE 120 msec), IR (TR 2500–2800 msec, TE 20 msec, TI 250 msec), and FLAIR (TR 7000 msec, TE 130 msec, TI 2100 msec) sequences. An experienced neuroradiologist and one of the authors (K.N.) reviewed all MR images for signs of MTS, such as signal changes and blurring of structures of the hippocampal formation and atrophy of the hippocampal formation and fornix.

Anatomical Analysis

One hundred temporal lobes were studied from the temporal pole to the level of the midbrain. Both T2-weighted and IR images (Fig. 2) were used to create a graphic outline of the basal cortical surface of contiguous slices (14–30 slices for each temporal lobe; Fig. 3). These line drawings allowed identification and marking of the course of the main sulci, and were used to create a sulcal map of each temporal lobe. The intrinsic relationship among the temporo-basal sulci (RS, CS, and OTS) was visually analyzed on the basis of the sulcal maps. In cases in which there was a discrepancy between maps based on T2-weighted images and those based on IR images, the sulcal pattern was determined by simultaneous assessment of the coronal images and graphic maps.

The maximum depths of the RS, CS, and OTS and the minimal distance from the fundus of each sulcus to the ventricle wall were measured on IR images (Fig. 4). The laterality of each sulcus was measured in the horizontal plane as the maximum distance between the sulcus and the medial margin of the temporal lobe. We used a computer workstation (SIENET MagicView 1000; Siemens Health Services, Erlangen, Germany) with a processing program (MagicView-VA31C; Siemens) to obtain the measurements.

The relation of the sulci to the relief of the floor of the lateral ventricle was visually rated on T2-weighted and IR MR images. Attention was drawn to elevations of the ventricle wall and how they related to one of the neighboring sulci.

Statistical Analysis

To obtain a general descriptive overview of the associa-
Sulcal anatomy of the temporal lobe

We identified the RS, CS, and OTS in all hemispheres. On a rostrocaudal sequence of images as well as in the assessment of the sulcal maps, the RS appeared as a separate sulcus on the mesial aspect of the temporal lobe, distinct from the CS, or as a sulcus that caudally joined the CS. The latter cases exhibited all types of relationships, ranging from a shallow transition between the sulci to a single continuous sulcus without a notable mark of termination of any sulcus. Similar to the sectional anatomy presented in the book edited by Ono, et al., we have always found a rostral sulcus in the mesial aspect of the temporal lobe, which we termed the RS, disregarding any separation or confluence with the CS. In the case of complete separation of the two sulci, the CS either followed the course of the RS or the CS emerged on a level at which the RS still prevailed. All three sulci appeared consistently. Essentially three patterns of temporobasal sulcal anatomy were found in the 100 hemispheres (Fig. 5): Type A, connecting sulci (33 hemispheres); Type B, separated overlapping sulci (31 hemispheres); and Type C, separated nonoverlapping sulci (36 hemispheres).

The OTS, which was located lateral to the CS and RS, rarely connected with the CS (two patients) or the RS (one patient).

Results

Visual Analysis and Measurements

We identified the RS, CS, and OTS in all hemispheres. On a rostrocaudal sequence of images as well as in the assessment of the sulcal maps, the RS appeared as a separate sulcus on the mesial aspect of the temporal lobe, distinct from the CS, or as a sulcus that caudally joined the CS. The latter cases exhibited all types of relationships, ranging from a shallow transition between the sulci to a single continuous sulcus without a notable mark of termination of any sulcus. Similar to the sectional anatomy presented in the book edited by Ono, et al., we have always found a rostral sulcus in the mesial aspect of the temporal lobe, which we termed the RS, disregarding any separation or confluence with the CS. In the case of complete separation of the two sulci, the CS either followed the course of the RS or the CS emerged on a level at which the RS still prevailed. All three sulci appeared consistently. Essentially three patterns of temporobasal sulcal anatomy were found in the 100 hemispheres (Fig. 5): Type A, connecting sulci (33 hemispheres); Type B, separated overlapping sulci (31 hemispheres); and Type C, separated nonoverlapping sulci (36 hemispheres).

The OTS, which was located lateral to the CS and RS, rarely connected with the CS (two patients) or the RS (one patient).
The depths of the three sulci ranged from 2.5 to 16 mm for the RS, 4.9 to 18.6 mm for the CS, and 5 to 15.8 mm for the OTS (Table 2).

The minimum distance to the ventricle wall measured 2.5 to 9.2 mm for the RS (means 4 mm on the right side and 4.1 mm on the left side), 2.5 to 8 mm for the CS (means 3.8 mm on the right side and 3.95 mm on the left side), and 3 to 12.6 mm for the OTS (means 4.4 mm on the right side and 4.95 mm on the left side).

With respect to the medial margin of the temporal lobe, the maximum laterality of the RS ranged from 5 to 17 mm (means 10.2 mm on the right side and 10.15 mm on the left side). The CS was located 6.2 to 21.3 mm (means 11.5 mm on both sides) and the OTS was located 18.9 to 33.8 mm (means 26.5 mm on the right side and 25.6 mm on the left side) lateral to the medial margin of the temporal lobe.

The temporobasal sulci closely approach the lateral ventricle and may induce a shallow elevation of the ventricle floor, which is termed the eminentia collateralis. An eminentia collateralis was found in 60 of 100 temporal lobes, but it corresponded to the CS in only 47 cases. In 19 cases the RS and in five cases the OTS contributed to a notable elevation in the relief of the floor of the lateral ventricle (Fig. 6).

**Statistical Analysis**

There was a tendency for sulcal pattern Types A and B to appear more often in male patients, whereas Type C occurred more frequently in female patients (p = 0.011, chi-square test; Fig. 5 lower). All other characteristics seem to have no association with sulcal pattern: there were no statistical correlations between the side of epileptic focus, side of seizure origin, the mean difference was 2.5 mm greater when seizures originated in the right hemisphere (p = 0.0026).

**Previous Investigations**

There is controversy about the definition of the RS in different sulcal patterns. The term has been applied to different anatomical structures in historical as well as recent neuroanatomical reports. Some neuroanatomists assert that the human brain usually lacks a clear-cut RS or that the RS is not spatially related to the ERC, and other researchers restrict the term to a shallow, vertically oriented sulcus at the rostral border of the uncus. According to comparative anatomical studies performed by Insausti, this interpretation is phylogenetically correct because it is based on homologies of sulcal anatomy between nonhuman primates and humans. Some researchers define the human homolog of the RS as the rostral segment of the CS, but it is unclear how far the variably extending RS is indeed homologous to the human homolog of the RS, which Insausti would call the “anterior collateral sulcus.” Nevertheless, it is unclear how far the variably extending RS is indeed homologous with the RS of comparative anatomy.

**Discussion**

Statistical analysis revealed an association only between the distance from the OTS to the ventricle wall and the side of seizure origin. The mean difference was 2.5 mm greater when seizures originated in the right hemisphere (p = 0.0026).

<table>
<thead>
<tr>
<th>Location</th>
<th>Depth (mm)</th>
<th>Distance From Ventricle Wall (mm)</th>
<th>Laterality (mm)</th>
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<tr>
<td></td>
<td>RS</td>
<td>CS</td>
<td>OTS</td>
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<td>9.55</td>
<td>12.4</td>
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<td></td>
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<td></td>
<td>mean</td>
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<tr>
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<tr>
<td>standard deviation</td>
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<tr>
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<tr>
<td>standard deviation</td>
<td>2.39</td>
<td>3.18</td>
<td>3.51</td>
</tr>
</tbody>
</table>

The differences in the distance from the fundus of the sulcus to the ventricle wall and the laterality of the sulcus were significantly different from zero for the OTS (p = 0.024 and p = 0.031, respectively, paired t-test). Linear regression analysis revealed an association only between the distance from the OTS to the ventricle wall and the side of seizure origin. The mean difference was 2.5 mm greater when seizures originated in the right hemisphere (p = 0.0026).
Sulcal anatomy of the temporal lobe

Differentiation between the anterior segment of the CS and the human homolog of the RS was methodologically not possible in this study. Considering the variability of sulcal patterns and the cytoarchitectonically defined terminology of the RS in comparative neuroanatomy, we selected the definition applied by Ono and other authors.\textsuperscript{15,38,43} The high variability of the anatomy of the temporal lobe has been studied since the 19th century. As cited in Stieda,\textsuperscript{52} Sernow observed a high variability in the course of the CS and OTS. Zuckerkandl\textsuperscript{65} reported on the existence of a well-developed “scissura limbica” in 86% of cadaveric specimens, referring to the RS, whereas Hanke\textsuperscript{18} found both the RS and CS consistently in 184 cadaveric hemispheres. In 40.9% of specimens examined in the latter study, the CS exhibited confluence with the RS, compared with 33% of the hemispheres observed in our study. Retzius\textsuperscript{43} demonstrated eight variations in the course of the CS. Hanke differentiated 24 variations in sulcal patterns of the CS and RS, based on the definition of four side branches of the RS. Correspondingly, Retzius differentiated between confluence of the sulci and separation between the CS and RS by a bridging gyrus. This gyrus, which was oriented laterally and anteriorly away from the PHG and directed toward the fusiform gyrus, was present in 60 of 100 hemispheres, more often in brains of women than in those of men. Sernow studied 100 nondiseased cadaveric brains and found a continuous “fissura temporalis quarta” from the temporal pole to the occipital lobe in 58.5% of the specimens, referring to the CS. In only two cases did he describe a separation in the anterior portion of the “fissura temporalis quarta,” which presumably related to a separate RS. In the remaining specimens the anterior or posterior extension of the CS was absent.\textsuperscript{52} Rarely (4% of cadaveric brains), a connection between the CS and OTS was observed. A meticulous analysis of the sulcal anatomy and variations in sulcal patterns was presented by Ono, et al.\textsuperscript{38} In a

![Magnetic resonance images demonstrating how the eminencia collateralis is caused by the underlying CS approaching the ventricle wall; the RS (center) or OTS (lower) can induce similar elevations of the floor of the temporal horn.](image)

![Graph demonstrating statistical analysis. Differences between anatomical measures in millimeters of the symptomatic side and the opposite side are calculated as the value of the symptomatic side minus the value of the opposite side for 48 patients with unilateral TLE. These differences show significant deviations from 0 for DVOS and LOS, indicating a reduction in these measurements on the symptomatic side. DCS = depth of CS; DOS = depth of OTS; DRS = depth of RS; DVCS = distance V of CS; DVOS = distance V of OTS; DVRS = distance V of RS; LCS = laterality of CS; LOS = laterality of OTS; LRS = laterality of RS.](image)

**TABLE 3**

Measurements of sulcal depth and distance from ventricle wall in autopsy specimens\textsuperscript{*}

<table>
<thead>
<tr>
<th>Location</th>
<th>Depth (mm)</th>
<th>Distance From Ventricle (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RS</td>
<td>CS</td>
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<tr>
<td>rt temporal lobe</td>
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</tr>
<tr>
<td>average</td>
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<td>9.4</td>
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<td>2</td>
</tr>
<tr>
<td>maximum</td>
<td>12</td>
<td>17</td>
</tr>
</tbody>
</table>

\* Data obtained from study by Ono, et al.
cohort of 25 autopsy specimen brains, a connection between the RS and CS was observed in 28% and the sulci were separated in 72%. In 28% of right-sided specimens and 32% of left-sided specimens, no overlapping of sulci was found.

Our results, which are based on an MR imaging analysis of the temporobasal sulcal anatomy, are in agreement with these studies on cadaveric specimens. The possible patterns and frequencies of the relationships between the RS and CS were similar to those listed in the study on 25 autopsy specimens. Side branching of the RS and CS was not assessed in our study because we did not expect to obtain reliable figures from an analysis of coronal MR imaging slices. Connections between the RS and OTS were seen in 1% and connections between the CS and OTS were seen in 2% of 100 hemispheres, which is less frequent than those observed in autopsy studies.185,52 Sex-related differences were observed in our cohort; that is, sulcal pattern Type C occurred more frequently in women. According to Retzius,43 however, generally there was a higher prevalence of separated RS and CS (corresponding to sulcal pattern Types B and C) in women (Fig. 3C).

Because there are no in vivo studies of exact measurements in this region available, we have assessed the depth, distance to the ventricle, and laterality of the RS, CS, and OTS. The postmortem study undertaken by Ono, et al.,38 revealed such measurements. Their figures are given in Table 3 to provide a comparison with our data shown in Table 2. Lang and Belz28 measured the length and width of the temporal gyri in 50 right and 50 left cadaveric hemispheres. They reported widths of 13.7 and 15.3 mm for the right and left PHGs and 17.1 and 17.2 mm for the right and left occipitotemporal gyri, respectively. These results are not directly comparable to our measurements because we measured the laterality of the sulci in the horizontal plane. Furthermore, minor differences in measurements in autopsy specimens are possibly effects of fixation or deformation of the brain during the fixation procedure.

Relevance for Epilepsy Surgery

The CS and RS can be used to define the lateral margin of the SA as macroscopic landmarks, delineating the ERC and parahippocampal cortex. Resection along these landmarks is advocated to prevent damage to the fusiform gyrus and to include the ERC as an important epileptogenic trigger zone (Fig. 1). The identification of anatomical landmarks on the ependymal floor of the temporal horn is supposed to warrant safe and precise resection of the PHG.4,6 By using the transsylvian–transventricular route, the floor of the temporal horn is incised along the lateral border of the hippocampus with the incision pointing to the CS. It is commonly assumed that the CS forms a protrusion, the so-called eminentia collateralis, that bulges into the temporal horn of the lateral ventricle.11,12 We, as well as Bronen and Cheung,11 have observed that not only the CS but also the OTS can cause an elevation in the floor of the ventricle similar to the eminentia collateralis (Fig. 6). This appearance might prove misleading during a microsurgical procedure because the CS represents an important landmark for the delineation of the PHG.6,4 The resection is extended subpially to the anterior PHG. The CS in some cases (Type A) directly leads to its anterior extension (RS). If, in contrast, the sulci overlap (Type B) and the identification of the CS alone determines the lateral limit of resection, a laterally terminating RS could escape notice. In some cases also the RS can form a protrusion in the ventricle floor.

With regard to a modified transsylvian–transcisternal approach, direct exposure of the PHG to the microsurgical view has been reported to reduce variability in resection volume.4 This effect could be caused by an improvement in intraoperative anatomical orientation. Similarly, the optimization of anatomical guidance could have a beneficial effect on the precision of the transventricular approach. Based on presurgical evaluation, SA was indicated in 41 of the patients of this study. All operations were performed by one of the authors (T.C.) via the transventricular approach. Subjectively, we always found the preoperative MR imaging analysis of sulcal patterns to be very helpful to the microsurgical procedure. We believe that the variability in resection volume does not necessarily measure the precision of the SA. The goal of possible refinement of this surgical procedure lies in the individual definition of the resection volume of the mesiotemporal seizure focus, reflecting the variable anatomical extension of the ERC in humans. An effect on the topographical precision of the resection, as measured on postoperative MR images, however, has not yet been proved.

Yaşargil and associates63 mentioned that the variable size of the parahippocampus and a lack of preoperative knowledge concerning its configuration poses a problem to the transsylvian route. At the time this surgical approach was developed, computerized tomography scanning and air ventriculography were incapable of providing an accurate preoperative anatomical assessment. Yaşargil and associates also called for imaging procedures that allow analysis of postoperative damage to the fusiform gyrus and the rest of the temporal lobe. Magnetic resonance imaging reliably displays the sulci and gyri of the basal temporal lobe.53 Our study shows that MR imaging can contribute considerably to the preoperative assessment of anatomical details of the temporal lobe; however, more detailed structural analysis poses new questions for the neurosurgeon. How valid are macroscopic details that serve as a delineation of a histologically variably extending cortical field? Does the individual variability influence the extent of the mediobasal resection? These issues will be discussed in the following section. Can one find a correlation between sulcal pattern and the extent of postoperative injury to nonepileptogenic tissue of the temporal lobe? Interestingly, since the development of MR imaging, few studies have been focused on the postoperative damage that occurs to the temporal lobe after SA2,26 and, so far, there are no data concerning the correlation with neuropsychological outcome available.

The ERC and its Anatomical Borders

In 1927 Rose64 differentiated 23 cytoarchitectural areas of the entorhinal region. He had already concluded, on the basis of the high differentiation of the entorhinal region in humans, that it was unlikely to be responsible only for olfaction. Based on comparative anatomical studies, the entorhinal region is regarded as a progressive structure in human phylogenesis.52 The combined cyto- and myeloarchitectonic studies conducted by Sgonina differentiated
five subregions with 24 subfields. Studies of pigment-enhanced architecture revealed 16 different allocortical areas in the entorhinal region. Hanke and Yilmazer-Hanke divided the ERC into 12 subfields based on the pigment-enhanced architecture of the superficial cortical layer. Insauti and coworkers differentiated eight subfields. So far there is no agreement on the number and classification of the cortical layers. Macroscopically, the ERC appears on the ventral aspect of the temporal lobe. It can be identified by a special wart-like surface structure (verrucae hippocampi). Similar to the difficulties encountered in cytoarchitectonic parcellation, there are discrepant descriptions of the lateral margin of the ERC. According to Insauti and coworkers, the lateral border of the ERC extends for some distance into the shoulder and medial bank of the collateral sulcus, where it forms an obliquely oriented boundary with the adjacent PRC. Rose described the lateral border as being sharply demarcated from the isocortex, whereas Braak conceived a transitional zone between the ERC and the neighboring isocortex, omitting the differentiation of the PRC. While attempting to resect the full extent of the ERC, one has to consider that the individual configuration and extent of the ERC varies according to the position and distance of the depth from the CS and CS. So does the localization of the adjacent PRC. Atrophy of the PRC has been in some patients with TLE. However, there is no evidence that resection of the PRC is relevant for treatment of TLE. Extensive resection of the mediobasal compartment does not seem to be advisable because the extent of mediobasal resection directly correlates with an increase in postoperative memory deficits. Preservation of this zone (the PRC) that functions in recognition tasks may avoid neuropsychological deficits and may explain differences in neuropsychological outcome after SA and larger resections of the temporal lobe.

The numerous discrepancies in terminology, subdivision, and delineation of the human ERC demonstrate the complexity of this region and indicate that the anatomy of the ERC and PRC is still not unanimously understood. Furthermore, it remains questionable whether volumetric assessment of a highly variable anatomical region that requires an arbitrary delineation can yield significant data. Nevertheless, only the combination of precise resection, histological assessment of resected tissue, and correlation with pre- and postoperative MR images will further elucidate the function and pathological conditions of the temporobasal cortex. The application of coregistration methods of pre- and postoperative volumetric MR images may contribute to the precise quantification of resected temporal lobe substructures. Hence, influences of individual anatomy could be evaluated with respect to clinical outcomes.

**White Matter Changes in TLE**

The results of the statistical analysis indicate that the OTS is located less laterally and approaches the ventricle more closely on the side of seizure origin, although it is not found to be deeper on that side. This phenomenon may be caused by atrophy occurring in the temporal lobe affected by mesial TLE. There is evidence that collateral white matter is reduced in the symptomatic temporal lobe. Meiners, et al., and Breier and associates have reported that atrophy of white matter in the PHG is a common finding in patients with hippocampal sclerosis. Histological assessment of temporal lobe specimens revealed that a decrease in myelin density might be the underlying abnormality of the white matter changes that occur with TLE. Metabolic changes within the white matter, exhibited on MR spectroscopic images corroborate this concept.

**Conclusions**

To our knowledge, no data about in vivo sulcal patterns and measurements in this highly variable region have been published. In this study we demonstrated that an assessment of individual sulcal anatomy of the basal temporal lobe is possible by examining routine preoperative high-resolution MR images obtained in patients suffering from epilepsy. The diligent analysis of individual anatomy shown in this report is very helpful to preoperative planning of the surgical approach. Disregarding variations in the ERC, for practical reasons the RS and CS still serve as reliable anatomical landmarks for SA. After the CS is encountered via the transventricular route, the continuation of resection of the PHG to the anterior extent can result in incomplete removal of the ERC if the type of sulcal pattern is not taken into consideration. Based on a plethora of recent literature on the role of the ERC in cases of TLE, we believe that even relatively small variations in the extension of the ERC related to gross anatomical patterns must be considered in the planning of microsurgical resection. We hypothesize that remnants of the ERC may account for therapeutic failures of SA that may require a second operation. Thus far we have not tested whether a certain anatomical pattern disposes to incomplete resection of the ERC; however, our data may contain valuable information for further assessment of postoperative outcome and topography of the resected volume.

**Acknowledgment**

We acknowledge the artistic illustration and technical assistance in the creation of surface maps of temporal lobes provided by Ms. I. Dobšak.

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