



Quality control of elective surgery for drug-resistant epilepsy in a German reference centre—A long-term outcome study

Anke M. Staack^{a,*}, Anne-Sophie Wendling^a, Julia Scholly^a, Ilona Wisniewski^a, Christoph Kurth^a, Josef Saar^a, Karin Mathews^a, Frédéric Bodin^{a,d}, Susanne Fauser^b, Dirk-Matthias Altenmüller^b, Thomas M. Freiman^c, Andreas Schulze-Bonhage^b, Josef Zentner^c, Gerhard Reinshagen^a, Bernhard J. Steinhoff^a

^a Kork Epilepsy Centre, Kehl-Kork, Germany

^b Epilepsy Centre, University of Freiburg, Germany

^c Department of Neurosurgery, University of Freiburg, Freiburg, Germany

^d Department of Plastic Surgery, Strasbourg University Hospital, Strasbourg, France

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ABSTRACT

Purpose: Resective epilepsy surgery is the recommended treatment for a well-defined group of patients with drug-resistant epilepsy. Long-term outcome studies are an appropriate quality control to assess the value of elective surgical procedures ethically and economically. This paper reports the long-term post-surgical follow-up of adult patients of the Kork Epilepsy Centre.

Method: Data collection was performed by means of a questionnaire to obtain updated information about postsurgical outcome, frequency and postsurgical seizure semiology in case of relapse, postsurgical use of antiepileptic drugs, social issues and satisfaction rates. We classified seizure outcome according to the ILAE surgery outcome scale (OC 1–OC 6).

Results: Outcome data of 340 adult patients were obtained. Mean post-operative follow-up was 6.7 years (range 1.0–21.6 years). Seizure remission was 67% if comprising patients with postoperative auras only (OC 1 + OC 2). Sixty-two per cent of patients were completely seizure free. The majority of patients (78%) underwent temporal lobe resections. Sixty-four per cent of these and 52% of the patients with extra-temporal resections became completely seizure-free (OC 1). Only 34% of the patients with negative MRI achieved complete seizure-freedom.

Conclusion: In line with others our huge cohort sample that covers decades of experience with epilepsy surgery revealed satisfying long-term outcome results. Best results were obtained in lesional temporal lobe epilepsy, least favourable results in MRI-negative epilepsy.

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1. Introduction

In spite of all achievements of modern antiepileptic drug (AED) treatment, still approximately 30–35% of patients with epilepsy suffer from drug-resistant epilepsy.^{1,2} In these patients epilepsy surgery may be the first-line treatment option. The rate of seizure freedom strongly depends on the epilepsy syndrome, the brain region of interest and the presence of a MRI detectable lesion.² Patients with epilepsy due to hippocampal sclerosis, focal cortical dysplasia (FCD) or dysontogenetic neuroepithelial tumours who underwent anterior temporal lobe resection or

lesionectomy in the temporal lobe are estimated to have a chance of seizure remission of 60–80%.^{3–6} MRI-negative epilepsy is associated with a worse outcome.^{4,7–13} At the Kork Epilepsy Centre, epilepsy surgery in adults was initiated more than two decades ago and has been consequently continued until today. The responsible staff and the keystones of the programme remained very stable. In terms of quality control it is necessary to rely not only on external data and standards but also to assess the quality of presurgical diagnostics and epilepsy surgery at our centre compared to others and internally over the long-term. It is even more important to evaluate the quality of our surgical activity because of the character of an elective and irreversible resection of brain tissue and its possible consequences such as neuro-functional or neuro-cognitive deficits. Thus, our aim was to improve our knowledge about long-term results of epilepsy surgery in our own series.

* Corresponding author at: Epilepsiezentrum Kork, Landstrasse 1, 77694 Kehl-Kork, Germany. Tel.: +49 7851842416; fax: +49 7851842600.

E-mail address: astaack@epilepsiezentrum.de (A.M. Staack).

2. Methods

2.1. Patients and data collection

Our database includes all adult patients ($n = 440$) of the Kork Epilepsy Centre who have undergone epilepsy surgery since 1988. Eighty-five per cent of these patients have been operated by one of us (JZ) and his team at the Neurosurgical Department at the University of Freiburg, Germany.

In all of these patients clinical data were collected in detail. Presurgical investigations took place in our tertiary epilepsy centre. In each patient we performed long-term scalp-video-EEG-monitoring, magnetic resonance imaging (MRI), neuropsychological testing and – if necessary – further exams such as fluorodesoxyglucose-positron-emission-tomography (FDG-PET), high-field MRI (1.5–3.0 T), voxel-based morphometry, functional MRI (language and motor), Wada-test, ictal and interictal single photon emission computed tomography (SPECT) or magnetoencephalography (MEG). Patients were investigated with invasive recordings (subdural and depth electrodes), when non-invasive presurgical evaluation did not allow proper definition of the limits of resection or to identify eloquent cortex. Invasive recordings were performed at the University of Freiburg.

A special case conference designated to surgical candidates was held to discuss the results of the presurgical evaluation and to decide the extent and limits of resection in each particular case.

Postoperative controls included clinical examination, evaluation of seizure remission or relapse, interictal EEG, MRI and neuropsychological testing in each patient and were routinely performed three months and one year after surgery. If a patient was not seizure-free, long-term video-EEG with ictal recordings was performed again.

Our database contained information about the kind of surgery, histopathology and postsurgical complications.

2.1.1. Assessment of update post-operative outcome data

We used a standardized questionnaire to obtain updated information about postsurgical outcome as seizure-remission, frequency and kind of seizures when relapse in comparison to the pre-operative seizure frequency, information about AED treatment as well as patient's satisfaction and actual social and professional situation. This questionnaire permitted us to reach 320 of the total 440 operated patients who live far away from our centre. Two hundred and twenty patients filled in the questionnaire and sent it back in between 3 months. If the questionnaire was not filled out correctly, we called patients and their relatives to clarify our questions. In addition, those 120 patients who had been identified by means of the database mentioned above and lived close to our centre were seen together with family members or friends between March and May 2011 in our outpatient's department. Each patient gave us individual consent to use the data for study purpose.

2.2. Seizure outcome classification

We classified seizure outcome at the time of the post-surgery follow-up evaluation (most recent observation, means March–May 2011) according to the ILAE (International League Against Epilepsy) surgery outcome scale (OC 1–OC 6).^{14,15} According to this, patients had at least been seizure-free (OC 1) in the previous year before the time of the last recent observation.

ILAE outcome scale (OC)¹⁴

- OC 1: completely seizure free, no auras
- OC 2: only auras, no other seizures
- OC 3: one to three seizure days per year \pm auras

- OC 4: four seizure days per year to 50% reduction of baseline seizure days \pm auras
- OC 5: less than 50% reduction of baseline seizure days to 100% increase of baseline seizure days \pm auras
- OC 6: more than 100% increase of baseline seizure days \pm auras.

2.3. Statistical analysis

The total number and percentage were achieved for the non-parametric variables.

For qualitative variables, the statistical differences were calculated using the chi-square test. For continuous values, one-way analysis of variance (ANOVA) was run with Statistica (Statsoft[®], version 8.0).

3. Results

3.1. Demographic data

Out of a total of 440 patients we were able to obtain complete outcome data of 340 patients at the last observation carried forward. One-hundred patients could not be included due to a loss of current addresses, a lack of motivation to participate, interfering confounding factors such as psychogenic seizures or death ($n = 5$).

Mean follow-up since surgery was 6.7 years (range 1–21.6 years).

174 male and 166 female patients participated in this study. Mean duration of epilepsy until surgery was 24.9 years (range 1–56 years); mean age at the time of surgery was 38.6 years (range 18–69). Neither the age at the time of surgery nor the duration of epilepsy had any influence on the post-operative outcome in our series as illustrated in Figs. 1 and 2, even if we addressed subgroups (duration of epilepsy before epilepsy surgery: 1–10 years; >10 < 20 years; >20 years).

3.2. Post-operative outcome in the whole population

At the time of the last recent observation in May of 2011, 211 patients (62%) were completely seizure-free (OC 1) for at least one year. Including patients who have had seizure remission except auras (OC 1 + OC 2) the number increased to 228 (67%). If surgery had taken place less than 7 years ago ($n = 194$), the percentage of

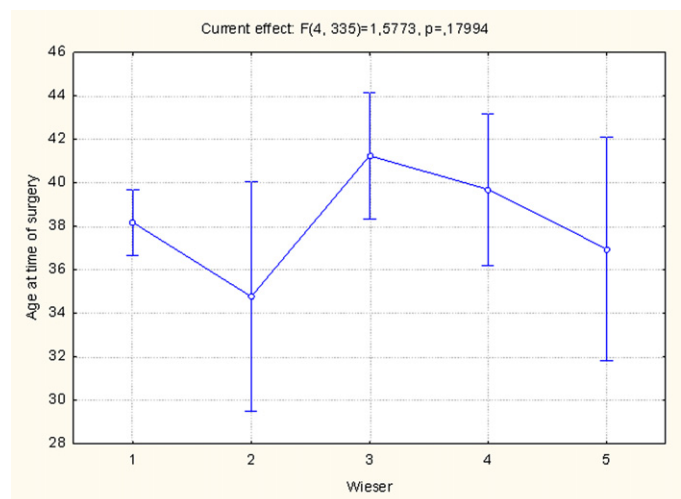


Fig. 1. Influence of the age at the time of surgery on the postsurgical outcome Wieser 1–5 (ILAE OC 1–5¹⁴) – no significant influence was shown with one-way analysis of variance (ANOVA).

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