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EPILEPSY SURGERY WITHOUT INVASIVE EEG

EARLY RESULTS OF A NEW PROGRAM

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ABSTRACT - A total of 42 patients were submitted to a clinical, behavioural and neuropsychological evaluation with the objective of eventual surgical treatment of epilepsy refractory to the usual clinical therapies. Prolonged video-EEG monitoring, MRI hippocampal volume measurement, lateralization of speech and memory using the amobarbital (Wada) test were used. Of 18 operated cases, 12 were submitted to temporal lobectomy, with a follow-up of 6-30 months; 8 patients had significant improvement in seizures control; 2 patients had partial improvement in seizure frequency and intensity; 2 patients had no improvement in seizure control. One patient underwent right frontal lobectomy with total remission of seizures and 5 had callosotomy with varying degrees of success. There was no mortality. Morbidity included one subdural hematoma, one transient hemiparesis, one episode of mania, one lobar pneumonia and frequent immediately post-operative muscular tension headaches. These early results indicate good results of temporal lobectomy patients investigated through a non-invasive presurgical evaluation.

KEY WORDS: epilepsy, epilepsy surgery.

Cirurgia de epilepsia sem EEG invasivo: resultados preliminares de um novo programa

RESUMO - No total, 42 pacientes foram submetidos a avaliação clínica, comportamental e neuropsicológica com o objetivo de eventual tratamento cirúrgico de epilepsia refratária aos tratamentos clínicos usuais. Monitorização de vídeo-EEG digital prolongado, avaliação do volume hipocampal por RM, lateralização de fala e memória pelo teste do Amobarbital (teste de Wada) foram utilizados. Dos 18 pacientes operados 12 foram submetidos a lobectomia temporal, com seguimento de 6-30 meses (média 17 meses), sendo que 8 encontram-se com melhora significativa do controle de crises, 2 com melhora parcial e em 2 não foi observada mudança substancial na intensidade e frequência de crises. Uma paciente foi submetida a lobectomia frontal direita com remissão total de crises. Cinco pacientes foram submetidos a calosotomia com graus variáveis de sucesso. Não houve mortalidade. A morbidade incluiu um hematoma subdural, uma hemiparesia transitória, um episódio de mania, uma pneumonia lobar e cefaléia tensional muscular frequente no pós-operatório imediato. Estes resultados preliminares indicam uma boa resposta do tratamento cirúrgico de epilepsia em um novo centro, com pacientes selecionados através de monitorização não invasiva.

PALAVRAS-CHAVE: epilepsia, cirurgia de epilepsia

New concepts indicate that a significant number of patients with epilepsy refractory to the usual clinical therapies may undergo successful surgery without the various techniques of invasive

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eletrocenphalography (EEG)[9]. These concepts apply especially to selected cases of temporal lobectomies, callosal sections and hemispherectomies[6,7,10]. These conceptual advances have made it possible for a greater number of institutions to develop smaller, less ambitious epilepsy surgery programmes with less investment in time, equipment and personnel. One attempt to develop an epilepsy surgery program had been made by the Neurology department in our hospital some years before[1]. In early 1993 the Neurosurgical and EEG departments became involved, with greater enthusiasm fed by the report of the second Palm Desert conference[6]. In May 1994 the Program for Epilepsy Surgery of Hospital Nossa Senhora das Graças was formally established, with the general objective of performing presurgical investigation and surgical procedures with results similar to those published in the specialised literature[6]. We aimed to establish only those procedures with predictable results. The first objective was to carry out temporal lobectomies and callosal sections with non-invasive investigation; the second objective was to develop extratemporal surgery for patients with lesions visible on neuroimaging; the third was to apply the same general concepts of surgery in adults to children, considering the differences in frequency of specific indications.

In this paper we report the results of the first 2 years of the programme (February 1994 to February 1996), which confirm the predictions specified above.

METHODS

The monitoring unit was based on a unit functioning in Sandvika, the epilepsy center serving the area of Oslo in Norway in 1992. Our version is a fully digital 2-bed 32-channel video/telemetry unit with automatic seizure/spike detection (Stellate Systems) with scalp/sphenoidal electrodes. Patients were submitted to the Montreal[12] and Seattle[5] techniques of the amobarbital (Wada) test[14]; to a neuropsychological evaluation with the WAIS and WISC, and Wechsler Memory Scales. Psychiatric diagnosis was made according to the DSM-IIIR[4]. A specific magnetic resonance (MR) technique was developed for quantitative hippocampal evaluation[13]. A total of 42 patients have undergone at least part of the presurgical evaluation. The majority of these patients were well known to the physicians; all were refractory to drug treatment, and had epilepsies which appeared to be amenable to one the surgical procedures the program was prepared to perform. As a general rule these patients were on rational antiepiletic drug regimens[3] and had their barbiturates and benzodiasepines withdrawn before surgical investigation[2]. All had clinical and laboratory screening, video moitoring and neuroimaging.

RESULTS

The age of the group was 2-52 years (mean 24) and 21 were female. Videomonitoring lasted periods between 8 and 114 hours (average 45). Decreases in dosage of antiepileptic drugs were used in all patients. The mechanism of decrease was based on the pharmacology of each drug. The patients had between zero and 55 seizures during monitoring (mean 4). Nine of the 42 patients did not have seizures. The epileptogenic regions indicated in Table 1 were determined by analysis of behaviour, ictal and interictal EEG during videomonitoring.

Of the 42 patients evaluated 18 have gone on to surgery. Of the 18 surgeries 8 were right temporal lobectomies, 4 were left temporal lobectomies, 5 were callosal sections and one was a right frontal lobectomy. Table 2 specifies the results of surgery in patients submitted to callosal section. Table 3 shows the results of surgery in patients submitted to temporal and frontal lobectomy.

Table 1. Location and laterality of epileptogenic region determined by videomonitoring in 42 patients including 2 patients with pseudoseizures and epilepsy.

Location	right	left	not lateralized
Temporal	11	11	-
Frontal	5	5	3
Parietal	3	1	-
Generalized	-	3	-

Three of the patients who did not have seizures during monitoring underwent temporal lobectomies based on the rest of the investigation, which indicated reliable localization of the epileptogenic area in one of the temporal lobes. Two of these are seizure free for respectively 19 and 10 months.

Table 2. Total number of seizures per month pre-operatively and post-operatively, follow-up and percentage improvement (post/pre-operation) in 5 patients submitted to callosal section. Average improvement for an average follow-up of 7.5 months was 39.4%.

Patients	pre-op seizures/ month	post-op seizures/ month	follow-up (months)	% change
DP	21000*	3	12	99,86
PC	15	15	8	0
JLWM	90	90	7	0
LL	90	63	6	30
OZC	180	60	4	67

* this number is correct

There have been no permanent morbidity or mortality from the presurgical or surgical procedures. Difficulty in the relationship with the families during the presurgical evaluation resulted in interruption of the evaluation in 3 of the 42 cases. One patient developed partial status epilepticus during drug withdrawal to precipitate seizures. There have been no complications of sphenoidal electrodes or of the amytal test.

The surgical procedure itself has led to cervical muscular tension headache and an area of temporary hair loss in practically all patients. The immediately post-operative headache has been

Table 3. Total number of seizures per month pre-operatively and post-operatively, follow-up and percentage improvement (post/pre-operation) in 12 patients submitted to temporal and 1 to frontal lobectomy. Average improvement for an average follow-up of 9 months was 88.9%.

Patients	pre-op seizures/ month	post-op seizures/ month	follow-up (months)	% change
RK	20	0	27	100
RTM	5	3	23	40
AA	30	3	23	90
VHe*	90	0	19	100
LCS	12	0	19	100
OBD	12	5	17	59
RP	25	0	16	100
CGF	24	0	15	100
MAGB	19	0	14	100
HCC	120	0	11	100
JDF	4	0	7	100
AR	10	0	5	100
VHo	30	0	4	100

* patient with frontal lobectomy

severe in some cases, and it has improved in 1-3 days. The circle of hair loss takes a few months to improve. Both appear related to the manner of head fixation during the surgical procedure. One patient (RM) had a subdural collection and a tonic clonic seizure in the immediate post-operative period. This was not treated and subsided spontaneously, but the patient became aphonic for a few days due to continuous conversation and laryngeal trauma related to the canulla. One patient had a lobar pneumonia and one left hemiparesis (AR) with minimal deficit after 5 months.

DISCUSSION

These early results of a new epilepsy surgery programme support earlier indications that there is an increasing indication for epilepsy surgery with non-invasive investigation[6,7,9]. The results also indicate that well-equipped and well-staffed general hospitals with a degree of expertise in epileptology may develop epilepsy surgery programmes in stages, starting with the more common, simpler and more secure indications and procedures. They should be able to funnel the more complex cases to centres with a specific ability in the area of that case.

The cornerstones of our Program appear to be a tradition of epileptology which emphasized clinical diagnosis and pharmacological therapy including drug trials; a sophisticated general hospital with good equipment and expert physicians in various areas; access to information from and training at world class centres; ability to develop reliable methods for essential non-invasive diagnostic techniques like prolonged digital videomonitoring with automatic seizure and spike detection; magnetic resonance imaging with quantitative and qualitative hippocampal measurement; a reliable and sensitive technique for the amytal (Wada) test[14]; finally, expert neurosurgery.

In the early 1990s data of various origins indicated that there were epileptic syndromes which could be predicted to be remediable to surgery and refractory to drug therapy. In summary, the new knowledge indicated that patients with a limited number of syndromes could have predictable results when submitted to specific surgical procedures; furthermore, these patients could be identified clinically, through non-invasive video-EEG and neuroimaging[9,15]. These patients form the majority of patients being investigated in traditional epilepsy surgery units, up to 80% in some[6]. These were the most successful patients and the most successful procedures, with remission rates of over two thirds for temporal lobectomies[6].

During 1995 and 1996 a few publications appeared, and the concept became established in the opinion of many experts, that in neocortical epilepsies the lesions were basic to the epileptogenic process[8,10,11]. In cases with lesions well defined in the MRI or CT, invasive monitoring came to serve the same purpose of non-invasive monitoring, i.e., making sure that the seizures arise from that location, rather than actually defining the exact resection boundaries. This concept was incorporated in the program, and development of more refined imaging became a renewed challenge.

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