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# Risk of Epilepsy After Aneurysm Operations

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## Summary

This prospective study was undertaken to evaluate the risk of epilepsy after aneurysm operations. The patients were discharged after operation without any anticonvulsant prophylactic treatment and followed-up for 12 months. Out of 128 such patients 121 were submitted for final evaluation. Epilepsy was diagnosed if two or more seizure attacks occurred during that time.

Such attacks occurred in 8 patients, so the risk of epilepsy was estimated at 7% for the 12 months after operation in patients without prophylactic treatment. In another 3 patients single seizures occurred during the follow-up, they were not treated with anticonvulsant drugs; seizures did not recur for up to two years.

Detailed analysis of the patients with late epilepsy revealed that most of them were pre-operatively in the 3rd clinical group according to WFNS scale. The rationale for the use of prophylactic anticonvulsants after aneurysm surgery seems to be doubtful in view of this study and data from the literature.

*Keywords:* Aneurysm surgery; postoperative epilepsy; prophylactic anticonvulsant.

## Introduction

The real risk of epilepsy after aneurysm operations is not known, so the rationale of prophylactic anti-epileptic treatment is not proven. Epilepsy after aneurysm surgery is rarely mentioned as the sequel influencing the final outcome. The few papers dealing with this problem of late epilepsy and prophylactic treatment cannot be compared due to many differences in approaching the problem. Some studies report rather high incidence rates, even over 25%[1, 2, 4, 5, 8–11, 13], while other papers present the opposite opinion concerning risk of seizures[3, 6, 7, 12, 14–16] and the value of anticonvulsant treatment.

The aim of this prospective study was to establish the frequency of epilepsy within 12 months after surgical treatment of ruptured and unruptured intracranial aneurysms in patients without prophylactic anticonvulsant treatment; such policy has been introduced for over two years in our Department now.

## Patients and Methods

Since the beginning of 1989 patients in our Department after aneurysm operations have not received any kind of prophylactic anticonvulsant treatment, unless epilepsy occurred. The patients were under the control of our patient department and after 12 months were finally checked personally or by letter.

The outcome was established in GOS and specially all events of seizures or equivalents of seizures were carefully noted. The study included all the patients who were discharged from the Department independently of aneurysm localization, timing of operation and early outcome.

The patients were operated on by 5 different neurosurgeons and anaesthetized by 2 neuroanaesthetists. Generally, the anaesthesia and the operations were performed in the same way, according to operative rules accepted in our Department. So intra-operative CSF drainage was routinely used, decadron and mannitol were given to minimize brain retraction. Peri-operative antibiotic prophylaxis was applied. Arterial hypotension was not used. In patients operated upon before 72 hrs after SAH nimodipine was administered topically and by continuous i. v. infusion for 10 days and orally for next two weeks. When necessary, postoperative hypervolaemia and hypertension were instituted.

All patients underwent operation using a standard, free bone flap, craniotomy (or craniectomy in the posterior fossa) according to the localization of the aneurysm. In cases with middle cerebral artery aneurysms (MCA) the Sylvian fissure was opened. After clipping (99% of cases) the aneurysm was punctured or sectioned to prove the proper placement of the clip, so no case was control angiography was performed.

The patients were discharged from the Department usually 2 weeks after surgery and from this point onwards we evaluate the follow-up.

Epilepsy was diagnosed in those patients in whom two or more epileptic attacks occurred independently of their clinical pattern. In such patients monitored anti-epileptic treatment was installed. The "single seizures" were not considered as epilepsy and after such an episode anticonvulsant treatment was not given.

Also patients in whom seizures occurred during SAH, after SAH and directly after operation did not receive prophylactic treatment.

Between 1 January 1989 and 31 March 1990 (15 months) 128 patients were discharged from the Department after aneurysm surgery and were followed at least for 12 months. From that number we had to exclude 7 patients: 4 patients were lost to follow-up, 2 patients died of unrelated causes during that time, 1 patient suffered epilepsy for many years before SAH and continued on anti-epileptic treatment after operation. So 121 patients were submitted for final analysis.

## Results

In the follow-up period of 12 months epilepsy developed in 8 out of 121 patients, that is 7%.

There were 70 women - 3 with epilepsy (4%) and 51 men - 5 with epilepsy (10%).

The age of the patients had little influence on the risk of epilepsy, however, it occurred more often in the group of younger patients (Table 1).

The pre-operative condition of the patients was of great importance. In patients operated on in grade III according to WFNS scale, the risk of epilepsy was considerably higher (Table 2).

Localization of the aneurysm and the risk of epilepsy is shown in Table 3. A slightly higher risk in patients with MCA is known from the literature.

Timing of the operation had no influence on the development of epilepsy (Table 4).

The final outcome of the surgical treatment after 21 months evaluated in GOS and epilepsy are listed in Table 5.

Table 1. *Age of Patients and Epilepsy*

| Age | No. of patients | No epilepsy | % |
|---|---|---|---|
| 40 y or less | 38 | 4 | 11 |
| 41 y–50 y | 34 | 3 | 9 |
| 51 y–60 y | 34 | 1 | 3 |
| 61 y and more | 15 | 0 | |

Table 2. *Status at Operation and Epilepsy*

| WFNS scale | No. of patients | No epilepsy | % |
|---|---|---|---|
| 0 (no SAH) | 3 | 0 | |
| I | 93 | 3 | 3 |
| II | 10 | 0 | |
| III | 14 | 5 | 35 |
| IV | 1 | 0 | |

Outcome is compatible with the pre-operative scale. Patients with very good outcome were usually in a better pre-operative condition and the risk of epilepsy was low.

All patients with epilepsy are listed separately in Table 6.

In 7 out of 8 patients there was some kind of structural pre- or postoperative damage to the brain: intracerebral haematoma, intraventricular bleeding or ischaemic changes. Epilepsy developed 4 to 11 months after surgery, mean 6 months. Monitored anti-epileptic treatment was successful in all the patients, no more fits occurred and patients are under our care.

In the 12 month follow-up period single seizures occurred in 3 patients. They occurred 1, 1 and 3 months after discharge from the hospital. The patients did not receive specific treatment and the seizures did not recur during further observation of 21, 18 and 14 months

Table 3. *Localization of Aneurysm and Epilepsy*

| Localization | No. of patients | No epilepsy | % |
|---|---|---|---|
| ICA | 26 | 1 | 4 |
| MCA | 29 | 4 | 14 |
| ACoA compl. | 40 | 2 | 5 |
| Multiple | 17 | 0 | |
| PCA | 3 | 0 | |
| PeCA | 1 | 0 | |
| BA /bif/ | 4 | 1 | |
| VA | 1 | | |

Table 4. *Timing of the Operation and Epilepsy*

| Days after SAH | No. of patients | No epilepsy | % |
|---|---|---|---|
| Up to 3 | 24 | 1 | 4 |
| 4–9 | 17 | 1 | 6 |
| 10 and more | 77 | 6 | 8 |
| No SAH | 3 | 0 | |

Table 5. *Outcome After 12 Months and Epilepsy*

| GOS scale | No. of patients | No epilepsy | % |
|---|---|---|---|
| GR | 96 | 4 | 4 |
| MD | 16 | 3 | 19 |
| SD | 9 | 1 | 11 |

Table 6. *Patients with Epilepsy*

| No. | Patient | Age | Sex | WFNS scale | Localization | CT | Epilepsy after : | Seizures pattern | Outcome GOS |
|---|---|---|---|---|---|---|---|---|---|
| 1 | O. G. | 35 | M | III | MCA | intracerebral haematoma | 6 months | GM* | SD** |
| 2 | Z. M. | 42 | W | III | ICA | pre-operative vasospasm | 6 months | GM | GR*** |
| 3 | O. R. | 34 | M | III | ACoA | pre-operative vasospasm | 11 months | GM | MD**** |
| 4 | Sz. A. | 49 | M | I | BA | postoperative hypodense area | 6 months | GM | GR |
| 5 | K. J. | 45 | M | I | ACoA | interhemispheric haematoma | 5 months | GM | GR |
| 6 | P. A. | 51 | W | I | MCA | normal | 5 months | temporal | GR |
| 7 | K. L. | 32 | M | III | MCA | intracerebral temporal haematoma | 4 months | GM | MD |
| 8 | M. W. | 34 | W | III | MCA | pre-operative vasospasm | 5 months | GM | MD |

* GM grand mal (generalized seizures), ** SD severe disabled, *** GR good recovery, **** MD mild disabled.

without anti-epileptic treatment. So the incidence of single seizures is not an indication for starting anticonvulsant treatment. One of those patients had to be shunted due to hydrocephalus.

We have analysed the group of patients in which seizures occurred in the peri-operative period, that means during SAH, between SAH and operation or after operation before discharge. There were 8 such patients. In 4 of them seizures occurred at the moment of SAH, in one of them between SAH and the operation and on the 7th postoperative day, in one of them between SAH and operation and in two of them during the postoperative period. Those patients were not put on anti-epileptic drugs. During the follow-up of 12 months one of the patients with seizures during SAH developed epilepsy 4 months after surgery (patient included in Table 6). This constitutes 13% of this group. The rest of those patients have been seizure free for 24, 18, 14, 14, 12, 12 and 12 months after surgery.

So even in the group of patients with seizures during the operative period, the initiation of anti-epileptic prophylaxis seems to be unnecessary, although the risk in this group is twice as high as in the remaining cases: 1 out of 8 = 13% and 7 out of 113 = 6%.

## Discussion

The problem of prophylactic anticonvulsant treatment after aneurysm surgery is still controversial. Several reports dealing with this problem give in many cases different conclusions and, moreover, usually cannot be compared due to many factors. It is necessary to define what we understand by late epilepsy and seizures. According to our and other opinions[7], epilepsy is diagnosed when the attack of seizures recurs, and one single attack of a seizure is not considered epilepsy. So the principle applied in our work, namely to diagnose epilepsy only when at least two spontaneous seizures occur, seems reasonable. Only in such cases was the anticonvulsant treatment started in our patients. Next is its necessary to be precise about what is meant by late postoperative epilepsy, as we are discussing the prophylaxis of such epilepsy. Keränen *et al.*[7] suggest that late epilepsy refers to the condition when attacks occur later than 1 week after operation. It is difficult to make a sharp distinction. We adopted the term for late epilepsy developing in the follow-up period which started in our patients usually 2 weeks after operation. At that time the acute posthaemorrhagic and postoperative excitation of the brain is perhaps over. A single seizure attack is not epilepsy and such an event should not be included in statistics of epilepsy.

Seizure attacks, single or repeated, during SAH, after SAH or few days after operation are usually the reaction to haemorrhagic or surgical trauma and are seldom a prognostic factor for late epilepsy.

The problem of prophylaxis is additionally complicated, as in many reports patients received prophylactic anticonvulsant treatment, sometimes started before operation. The treatment was continued for various periods of time, from 2–3 months to several years and with difficult antiepileptic drugs[4, 5, 7, 8, 11, 13, 16]. In earlier studies such treatment was not monitored by blood level estimation.

We present a rather uniform series of all surgically treated patients who did not receive anticonvulsant treatment and in whom the risk of epilepsy was about 7%. It is roughly comparable with some other reports[3, 6, 12, 14, 16] even concerning patients with prophylactic treatment. The risk of epilepsy after aneurysmal surgery probably tends to decrease with improvement in surgical technique and peri-operative medication. In view

of our results prophylactic anti-epileptic treatment in such patients is not justified. It is probable, that even if applied, it has no influence on the prophylaxis of late epilepsy, as in some reports in spite of prophylactic treatment the percentage of patients with epilepsy is the same or higher. The monitored anti-epileptic treatment is boring for patients, requires some limitations in everyday life and sometimes must be discontinued due to its side effects.

The risk of epilepsy was higher in younger patients of our series and in the group of patients observed by Fabinyi *et al.*[3]. The risk is higher in patients with aneurysms localized on the MCA, an observation mentioned in almost all papers. However, the risk is not high enough to start prophylactic treatment in all these cases.

There is some problem with patients in a very poor pre-operative condition (in our work grade III WFNS scale) in whom the risk of late epilepsy seems to be considerably higher. The same observations have been made by others. The number of such patients in our work is relatively small and they need further observation.

In our opinion pre-operative anti-epileptic prophylaxis is disputable. Single seizures in the peri-operative period occur relatively rarely, their sequel is negligible and they do not lead to late epilepsy in such numbers as to justify further antiepileptic treatment.

As in our series of patients the risk of late epilepsy in the first postoperative year was low and the value of prophylaxis is doubtful, we will continue our policy of not using any prophylactic anti-epileptic treatment in patients after aneurysm surgery.

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