

## OUTCOME OF 337 INTRACRANIAL ANEURYSMS PATIENTS OPERATED IN A PUBLIC HOSPITAL

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**ABSTRACT** - Many recent series of surgery for intracranial aneurysms have been based on experience of developed countries with great resources and a state of art health care. The purpose of the current study is to correlate the outcome of patients operated for intracranial aneurysms, reported from intensive high technology neurosurgical centers with the results of low technology, environment, where we practice. Between January 1986 and December 1996, 337 patients with intracranial aneurysms were operated on at the Servidores do Estado Hospital. We retrospectively reviewed the medical and radiologic records and compared the outcome of this group with other series derived from developed countries. The overall mortality of this series was 6.9%. Of the 313 good grades surgical patients, the mortality was 4.7% and the successful results were obtained in 88.8% individuals. We conclude that patients harboring intracranial aneurysms can be satisfactorily handled in less developed nations, if a meticulous intraoperative technique is employed, even though sophisticated technology and equipments are not available.

**KEY WORDS:** intracranial aneurysm, subarachnoid hemorrhage, microneurosurgery.

### **Resultados da cirurgia de 337 pacientes portadores de aneurisma intracraniano operados em um hospital público**

**RESUMO** - Séries recentes que analisam os resultados da cirurgia de aneurismas intracranianos são originadas de países com grande desenvolvimento médico e tecnológico. O objetivo do presente estudo é comparar os resultados dessas séries com os resultados obtidos por um serviço de neurocirurgia de um hospital público (HSE) no Brasil. A mortalidade geral neste estudo foi de 6,9%. Dos 313 bons candidatos cirúrgicos, a mortalidade encontrada foi de 4,7%. Neste grupo, 88,8% dos pacientes retornaram a sua vida prévia. Concluímos que pacientes com aneurismas intracranianos podem ser satisfatoriamente tratados em países menos desenvolvidos, se uma técnica cirúrgica metódica for empregada, mesmo sem dispormos de tecnologia cara e sofisticada.

**PALAVRAS-CHAVES:** aneurisma intracraniano, hemorragia subaracnóidea, microcirurgia.

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Great advancements have been seen in Neurosurgery. Among these, have been the introduction and development of instrumentation and microsurgical techniques for surgery of intracranial aneurysms. The advancement in techniques and technology in the last few years demands organization and great amount of fundings to replace equipments and in purchasing new technology. However, in countries where this is not the case, neurosurgeons have been made a great effort to optimize limited resources and a more selective approach may well be justified. Many recent series of surgery for intracranial aneurysms have been based on experience in developed countries with great resources and a state-of-art health care<sup>1-13</sup>.

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The intent of this study is to compare the outcome of patients operated for intracranial aneurysms reported from intensive high technology developed neurosurgical center with the results of low technology environment in which we practice.

## METHODS

### *Patients population*

During 11 year period (January 1986 - December 1996) 337 patients with a diagnosis of an intracranial aneurysm were operated in the Hospital Servidores do Estado (HSE). Data from each patient were collected retrospectively from their charts, operative notes and angiography. This information was recorded on a standard abstract sheet and stored in a computer for analysis. There were 214 (63.7%) woman and 123 (36.2%) men. Their ages ranged from 5 to 77 years (median age 45.4 years). The patient's condition at admission was classified according to scale of Hunt and Hess. The outcome were categorized as successful (full neurological recovery or minimal to moderate disability), unsuccessful (severe disability, a vegetative state and death). 313 patients (89.8%) were in good condition (neurological grades I to III) and 35 (10.2%) were in poor condition (grades IV and V) when operated on.

In 169 (50%) individuals, the ruptured aneurysm arose from the internal carotid artery (ICA), including the ophthalmic, posterior communicating or anterior choroidal arteries and the bifurcation. In 75 (22.2%) patients the aneurysm was located in the anterior communicating artery complex (ACOA). In 72 (21.3) individuals the aneurysm arose from the middle cerebral (MCA) ,and in 21 (6.2%) patients from the vertebral basilar system (VBS). 38 aneurysms (11.4%) were giant. Multiple aneurysm were found in 28.5% of the cases. Most of the patients in our series presented subarachnoid hemorrhage (SAH) (90.9%).

### *Management of cases*

All patients had bilateral carotid angiography and most of the patients had vertebral angiography as well. Computerized tomography had come into routine use in the evaluation of these patients during this period. Most of the patients were operated on 7 days or more following their last SAH. No antifibrinolytic agents were used. Steroids, and after 1991, venous or oral calcium antagonists were used routinely. Hypervolemic, hypertensive therapy was employed only after aneurysm clipping and development of cerebral vasospasm.

Transcranial doppler examination, transluminal ballon angioplasty, somatosensory evoked potential, as well as intraoperative angiography were not available in our institution during the period of this study.

### *Surgical technics*

Most operations were performed by the senior author (JCL), using an OPML-1 model of the Zeiss operating microscope (Carl-ZEISS, New York, USA).

The patient is placed in a Mayfield-tree pin head holder and the surgical approach for supratentorial aneurysms is the standard pterional craniotomy. Employing meticulous micro surgical techniques, the Sylvian, the carotid and the suprachiasmatic cisterns are widely open to expose the aneurysms. The aneurysms were then obliterated by clipping. Hypotensive anesthesia was never used in these series as well as lumbar cerebro-spinal fluid drainage.

The anesthetic monitoring consisted of ECG, digital oximetry, capnography, and intrarterial blood pressure. Close nursing observation of the patient in post operative period is undertaken in a general intensive care unit for a variable period of time, most often overnight. After that, the patient is transferred to neurosurgical ward until hospital discharge.

## RESULTS

The overall mortality of this series was 6.9% (23 patients). The successful results for all patients was 84.2% (284 patients) and unsuccessful 15.7% (53 patients).

Considering only the 313 good grades surgical patients (Hunt and Hess grades I to III), the successful results were obtained in 88.8% (278) patients with 11.1% (35 patients) in the unsuccessful category. The mortality in these group was 4.7% (15 patients).

### *Method of treatment*

Neck clipping was the goal of all operations. Satisfactory clipping of the aneurysm was accomplished in 91.4% of the aneurysms.

Proximal ligation or trapping of the aneurysm was performed only in 10 instances (3.1%). Wrapping was chosen in 16 aneurysms (4.7%).

In 26 patients (7.7%), the aneurysm ruptured on surgical procedure: 18 during the neck dissection and 6 at the neck clipping.

In the 38 patients, temporary clipping were used, with the time varying from 2 to 50 minutes. In the last 5 years the aneurysm has been routinely decompressed after clipping, by incision or needle aspiration.

## DISCUSSION

### *Timing of operation*

At the moment there is a tendency in neurological community to proceed with definitive aneurysmal surgery as soon as logistically possible, at least in patients in good condition. However, the timing of aneurysm surgery remains controversial and currently there are no definitive data to support an universal policy of either early or late surgery<sup>1-6,8,10,11</sup>.

In this series most of patients were operated on 7 days or more following their last SAH and after the immediate effect of the SAH had passed.

### *Method of treatment*

Surgical results in cases of ruptured cerebral aneurysm have improved with the introduction of the operative microscope.

In this series, the aneurysms were clipped in 91.4% of the cases. Artiola et al.<sup>14</sup> clipped 87.9% of the aneurysms. Nornes and Wikeby<sup>7</sup> reported 85% of successful clipping. Temporary clipping were used in 38 instances, the time varying from 2 to 50 minutes. Rupture during dissection or clipping occurred in 25 patients (7.4%). Batjer and Samson<sup>15</sup> and Yasargil<sup>13</sup> reported similar pattern of intraoperative aneurysm rupture.

### *Assessment of Outcome*

Several large series of patients submitted to early or late surgery after aneurysmal SAH have been published to date. All these series come from developed countries with great resources and state-of-art medical care<sup>1,2,4,6-11,13,16-20</sup>.

The microsurgical era began with the paper of Krayenbühl et al.<sup>16</sup> Excellent/good results were obtained in 83% of the entire series. There were no death in 112 grade I and II patients.

Nornes and Wikeby<sup>7</sup> presented successful results in 80% of the good/excellent patients. Sundt et al.<sup>9</sup> operated on 722 patients with intracranial aneurysm. They obtained excellent or good results in 87% of patients, in 13% the results were poor or the patient died. Ljunggreen et al.<sup>18</sup>, operated on 105 patients in the acute stage. Of 95 grade 1 to III patients who were operated on, 76% recovered without neurological deficits and 4% died. The same group, in other similar study showed nearly corresponding results<sup>5</sup>.

Chyate et al.<sup>2</sup> analyzed 244 patients admitted at Mayo Clinic. Eighty-five patients underwent surgery between zero and 3 days following SAH, 83 patients between 4 to 9 days and in 50 individuals the surgery to secure the aneurysm was done 10 days or more after the SAH. Successful results were obtained in 80.2% of the patients operated in acute stage and 78.6% of the late surgery group. Ohman and Heiskanen<sup>8</sup> obtained full neurological recovery or moderate disability in 83.4% of their good candidate patients. Krupp et al.<sup>4</sup> have presented their results of 131 patients that underwent late operation. They achieved excellent/good patients outcome in 85% of their good grades post HSA patients.

More recently, Le Roux et al.<sup>17</sup> studied 543 individuals admitted with SAH, during a 10-year period, utilizing state-of-art medical care, like as special neurosurgical intensive care with routine intracranial pressure, invasive hemodynamic monitoring, daily transcranial doppler examination,

Table 1. Surgical outcome in good grade\* subarachnoid patients.

Authors	Year	Timing	Successful outcome excellent/good	Unsuccessful outcome poor/death
Post et al. <sup>19</sup>	1977	LS	70.0	30.0
Nornes and Wikeby <sup>7</sup>	1979	LS	80.0	20.0
Adams et al. <sup>1</sup>	1981	LS	55.7	44.2
Sundt et al. <sup>9</sup>	1982	LS	87.0	13.0
Shephard <sup>20</sup>	1983	ELS	63.6	36.3
Yasargil <sup>13</sup>	1984	LS	94.7	5.3
Ljungren et al. <sup>18</sup>	1985	ES	76.0	24.0
Chiatte et al. <sup>2</sup>	1988	ELS	77.5	22.4
Ohman and Heiskanen <sup>8</sup>	1989	ELS	83.4	16.5
Miyaoka et al. <sup>6</sup>	1992	LS	80.2	19.8
Miyaoka et al. <sup>6</sup>	1992	ES	78.6	21.4
Krupp et al. <sup>4</sup>	1994	LS	85.0	15.0
Le Roux et al. <sup>17</sup>	1995	ES	86.6	13.4
Lynch et al.	1996	LS	88.7	11.3

ES, early surgery; LS, late surgery; ELS, early and late surgery.

\*Good grade: Hunt & Hess grades I to III.

early surgery and aggressive treatment of vasospasm. They present favourable outcome in 86.6% of the Hunt & Hess grades I to III<sup>21</sup>. Yasargil<sup>13</sup> reviewed his series of 1012 aneurysm patients operated upon. The great majority of the patients had late surgery. He claimed excellent/good results in 94.7% of this good grade patients (Table 1).

In this present series, 337 patients were operated upon for intracranial aneurysm. The overall surgical mortality was 6.9% (23 patients). Considering Hunt e Hess grades I to III<sup>21</sup>, there were 313 patients operated upon. Of these, 278 (88.8%) achieved satisfactory outcome (they could return to their pre-morbid level, some with minor neurologic deficits). In the unsuccessful category, 35 patients (11.3%) had poor outcome.

The majority of the operations, in this study, were performed after 7 days of SAH. These patients have survived the acute stages of SAH, the rebleedings in the early period of SAH and problems related to vasospasm. Also in this situation, the effects of acute hemorrhage had decreased, thus making the surgery easier to perform. These facts most probably improve our results when compared with series of patients who were operated on in acute stages of aneurysms SAH.

Ideally, the state-of-art health care should be offer to all patients, but practically, patients should receive optimum management with available resources. In the present study, the overall management results for patients grade I to III compare with those previously reported from developed countries with high medical development and new technology. We conclude, based on the data reported that selected patient population harboring intracranial aneurysms can be satisfactorily handled in nations with lower-technology, if a meticulous intraoperative technique is employed, even though sophisticated technology and equipments are not available.

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