DE GRUYTER OPEN

Romanian Neurosurgery (2015) XXIX 4: 417 - 426 417

DOI: 10.1515/romneu-2015-0057

Small and medium size intracranial aneurysms - a 5 years retrospective analysis trial and multimodal treatment

Valentin Munteanu[1], Mircea Radu Gorgan[2]

[1]Ph.D. student in Neurosurgery, University of Medicine and Pharmacy "Carol Davila" Bucharest, Faculty of Medicine, Department of Neurosurgery, Clinic of Neurosurgery, M.D. Emergency Clinical Hospital "Bagdasar – Arseni"

[2]Professor in Neurosurgery MD, PHD, University of Medicine and Pharmacy "Carol Davila" Bucharest, Faculty of Medicine, Department of Neurosurgery, Clinic of Neurosurgery; Head of department Clinic of Neurosurgery ,Emergency Clinical Hospital, "Bagdasar – Arseni", Bucharest

Abstract: Clinical context. Subarachnoid hemorrhage (SAH) due to rupture of an aneurysm is one of the most common neurosurgical emergencies who account for one-third of stroke .In the SAH cases , aneurysms accounted for 70%. Aneurysms had a bleeding rate of 12 per 100,000 population per year, and in particular between 50 to 60 years of age with a high morbidity and mortality, especially in the first episode of bleeding at about 43% of cases (1, 4, 14). Surgery is indicated to prevent rebleeding. 2.5% of patients in the general population may have unbroken aneurysms with a prevalence of 0.65%, with a preponderance of aneurysms in a 2: 1 in women. ACI aneurysms are more common in women and Acom aneurysms are more common in men and in 15-30% of patients with presence of multiple aneurysms. Surgical timing, the assessment in each individual case for rebleeding usage of endovascular techniques (3, 12), neurological status, the presence or absence of intraparenchymal hematoma or intraventricular hemorrhage with or without vasospasm, have an influence on the result. Over a period of 5 years from January 2010 to November 2014, 317 cases of patients with intracranial aneurysms in four clinics of neurosurgery in Bagdasar -Arseni hospital have been studied. The follow up period range between 6 month and 4 years and 3 month.

Key words: aneurysm size, SAH, timing, microneurosurgery.

Introduction

The authors of this work are concerned with the correlations between small and medium size aneurysms, shape and location and their real risk of bleeding and rebleeding. The data obtained are safe choices for both patient and surgeon in choosing the right surgical technique or for abstention from surgery. Nothing replaces clinical judgment (6, 11, 12).

It is therefore necessary to advice each patient individually. It is necessary to consider and take into account all the variables of the patient life and clinical aspects of current aneurysmal lesions. (size, location, HTA, patient age, alcohol, smoking, a history of bleeding drugs, hereditary history, fungal and bacterial infections, comorbidity, cystic kidneys, sex). Based on all this information, the individuality of the patient can be appreciate (7, 8).

Intracranial sacular type aneurysms occur in about 1-2% of the population. Intracranial aneurysms are found more and more often with non-invasive imaging acquisition techniques in clinical practice. Once an aneurysm is detected unruptered, decisions on the optimal management will be based on careful comparison of short- and long-term risk of rupture of the aneurysm through natural history with risks associated with the intervention itself, whether is open surgery or endovascular technique. Several factors should be carefully considered, including the size and location of the aneurysm, family history of the patient and medical history, and the availability of interventional possibilities that has an acceptable risk (9, 13). Patient information about having an unruptered intracranial aneurysm can led to stress and cause significant anxiety. Is it of utmost importance choosing right treatment type? Controversy remains regarding the optimal management and detailed assessment of the risks and benefits for the patient. Benchmarking with other similar studies will enable us to ensure correct positioning among other neurosurgical departments. For example:

Description of 128 patients with subarachnoid hemorrhage

Parameter	N = 128
Age (mean years ± SD)	53.1 ± 12.1
Hunt and Hess grades	
Grade 1	47.3%
Grade 2	20.5%
Grade 3	18.1%
Grade 4	14.2%
Aneurysms identified	74.2%
AcomA	30.5%,
MCA	22.7%,
ACA	13.3%,
Ophthalmic artery	4,7%
BA	4.7%
PICA	1.6%
SCA	0,8%
VA	2,3%
Multiple aneurysms	6,2%
Fisher grades (n = 125)	
Grade 1	10%
Grade 2	46%
Grade 3	17%
Grade 4	27%
Hydrocephalus on admission	35.9%
Recurrent hemorrhage	7.8%
Surgery	64.1%
Coil embolization	9.4%
Temporary clipping during surgery	28%

ACA = anterior cerebral artery, AcomA = anterior communicating artery, BA = basi- lar artery, MCA = middle cerebral artery, PICA = posterior inferior cerebellar artery, SCA = superior cerebellar artery, SD = standard deviation, VA = vertebral artery.
Data from three patients are missing.
Journal of Clinical Neuroscience 16 (2009) 1409–1413

Clinical Study

The prediction of long-term outcome after subarachnoid hemorrhage as measured by the Short Form-36 Health Survey

Wolfram Scharbrodt, Matthias F. Oertel*
Department of Neurosurgery, University Hospital Giessen, Klinikstrasse 29, Giessen 35385, Germany

Clinical material and method

This study is dedicated to small and medium intracranial aneurysms.

The study covers a period of 5 years between January 2010 and November 2014, using the Neurosurgery Clinics of the Bagdasar- Arseni Hospital experience data. Is a retrospective study including 317 patients

DOI: 10.1515/romneu-2015-0057

admitted into the hospital. Our intention is both to establish the variability of cases in our clinic departments, and effectiveness of used therapeutic methods, with real benefit for the patient - an attempt to establish an effective therapeutic algorithm.

The observation period varies between 24 hours and 4 years and 3 month. Between studied patients, because some of them overturned surgery, others were transferred to other hospitals or just could not follow any data, had been excluded 27 patients. The study comprises 317 patients from whom correct data have been achieved. In this group are 185 women account for 58.3%, 132 men -41.7% with ages between 29 and 82 years old.

The symptoms for this patients at presentation are extremely variable, from almost asymptomatic patients, mild transient headaches, cranial nerve and motor deficits up to coma GCS = 3p.

Scaling system and evaluating patients are according with international systems: Glasgow Coma Scale, scale WFNS, Hunt & Hess scale, Glasgow Outcome Scale, motor deficits ASIA Fisher scale. Classification of vascular lesions is of international usage: size: microaneurysms <2 mm, small Ø = 2-7mm, medium Ø =7-12mm, large Ø = 13-24mm, huge Ø> 25mm Aneurysms by Form: saccular (berry), fusiform, dissecting (pseudo-aneurysms).

240 of the cases studied, presents on admission with bleeding phenomena such as subarachnoid hemorrhage accounting for 75.70%. Depending on the severity were assessed by Glasgow Coma Scale (Figure 1).

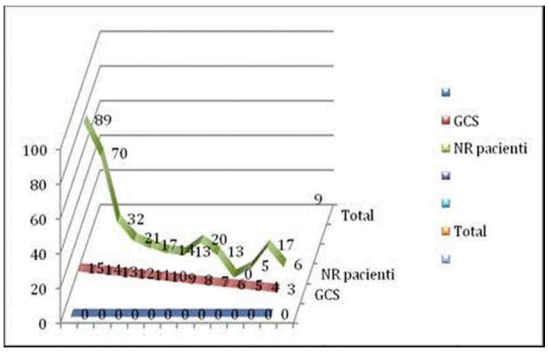

Figure 1 - Neurological status assessed by GCS scale

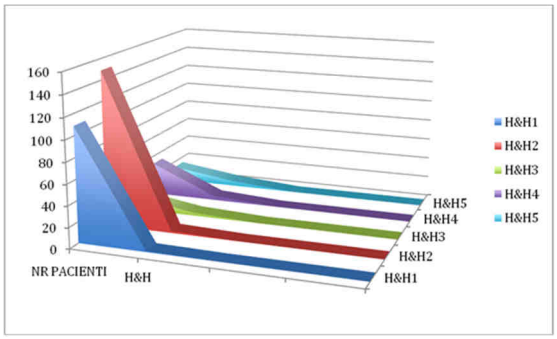

Figure 2 - SAH cases assessed by Hunt & Hess scale

TABLE 1

Neurological status at admission in SAH patients

NR PACIENTI	109	149	13	32	14
H&H	1	2	3	4	5

The 317 patients have been studied by imaging technique at their admission in the hospital. The main investigation was cerebral angiography (Figure3, 4), generaly achieved after 24 hours but in some cases Angio CT with or without 3D reconstruction (Figure 5, 6) – cases were the catheter could not be inserted into the internal carotid artery, MRI with Angio MRI in unruptured aneurysms (Figure 7, 8).

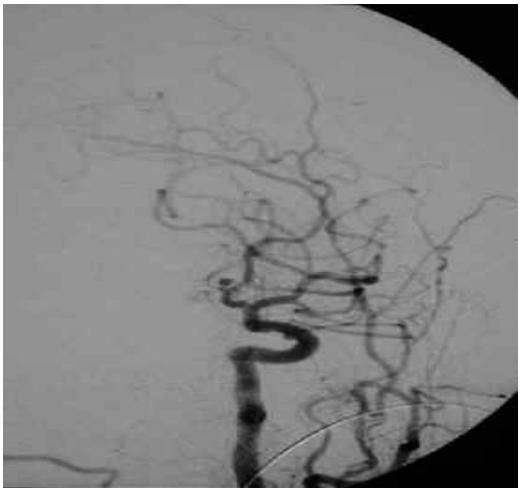

Figure 3 - Ant. comm. Artery aneurysm

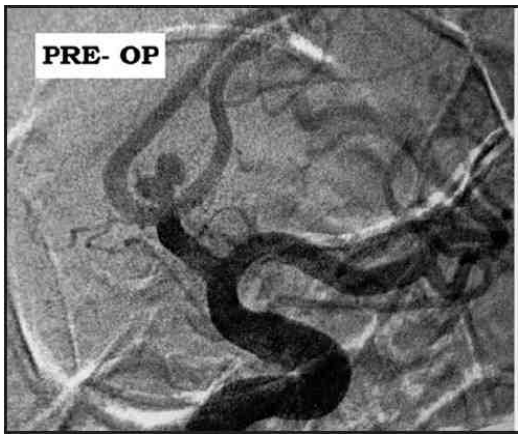

Figure 4 - Anterior communicating artery aneurysm with daughter sac

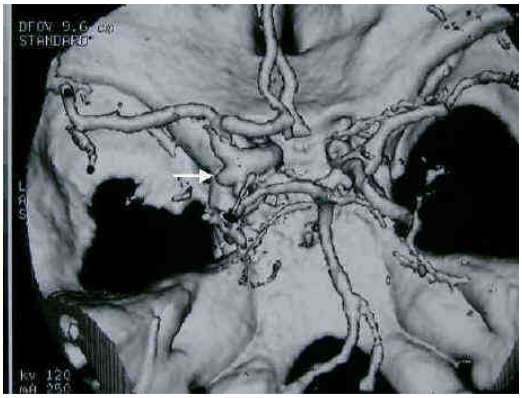

Figure 5 - CT angiography- showing right posterior communicating artery aneurysm

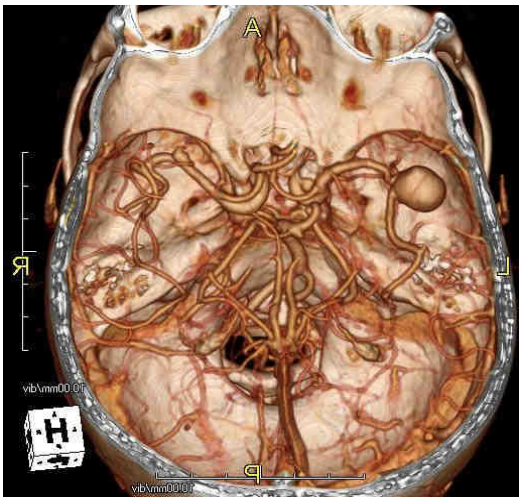

Figure 6 - CT angiogram - 3D left sylvian aneurysm

DOI: 10.1515/romneu-2015-0057

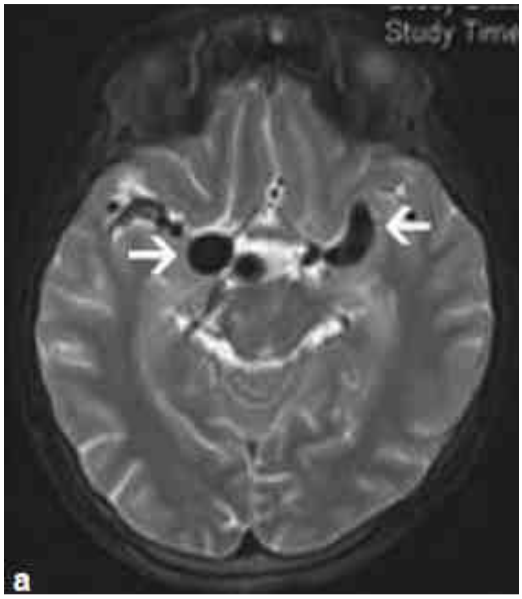

Figure 7 - MRI- Internal carotid artery aneurysm

Figure 8 - MR Angiography-multiple aneurysms

Results

A series of 237 aneurysms with various locations have been described. From all, 27 cases were multiple intracranial aneurysms. Among multiples diagnosed, 21 aneurysms were with 2 aneurisms, and 6 cases with more than two -with a maximum of 8 aneurysms (RM, female 39 years old, addressed in 2013 SAH, H & H = 1, GCS = 15, Fisher CT = 1, cerebral angiography 4 vessels: 1) saccular MCA right aneurysm Ø max = 4, 95 mm and neck = 6,94 mm 2) ophthalmic right artery microaneurysm, 3) internal carotid aneurysm left sausage-like section C7)4)5) two aneurysms segment C6 left, 6) posterior communicating artery microaneurysm left 7) basilar bifurcation aneurysm size Ø = 1, 78 mm neck = 1.37 mm 8) anterior communicating artery aneurysm size neck = 2,7 mm Ø = 2,13 mm – MCA aneurysm wrapping technique used).

Depending on the type of lesion discovered after investigations, especially after the angiography, management has been adapted as follow (Table 2).

TABLE 2

Various procedure for treatment

Treatment type				
Surgery	clipping	wrapping	Endovascular	EVD
no cases	79	7	63	16

Surgical procedure in 86 selected patients.

For each patient the operation was adjusted depending on the aneurysm location. Most frequently used approaches were pterional, frontopterional, suboccipital for posterior fossa lesions.

Site and size of the aneurysm, but also the neck direction contribute for the procedure used. Intraparenchymal hematoma, accompanying lesions, multiple aneurysms led to the modification of approaches. In all cases, we have used optical magnification systems-surgical microscope.

Unruptured aneurysms are more easily to dissect (Figure 9).

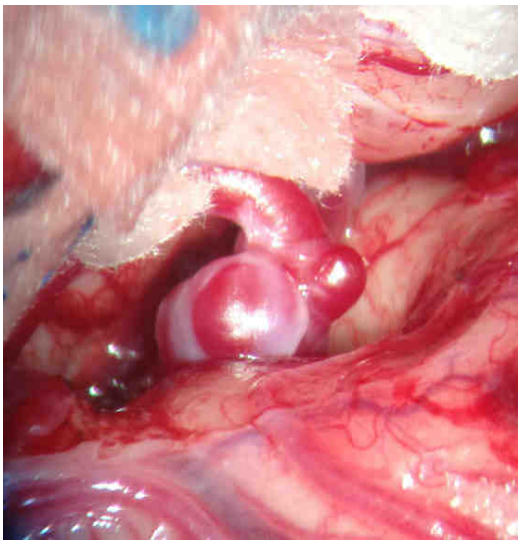

Figure 9 - Intraoperative image-unruptured aneurysm

Intraoperative capture using Leyca microscope:

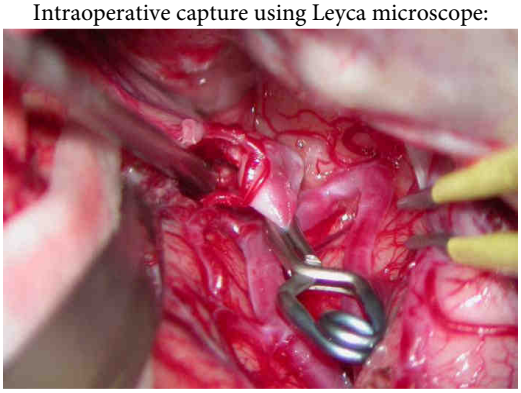

Figure 10 - Intraoperative image – aneurysm after clipping

The clips are very effective in taking out an aneurysm (Figure 10). Regrowth of an aneurysm after an adequate clipping is as small as 1%. This is one of the biggest advantages over endovascular coiling. In addition, after clipping only one angiographic follow-up is required.

The main disadvantage of the clipping is of course the brain operation itself (including scarring, infection, bleeding) and the risk of brain damage.

Once the clip in place and the aneurysm secured, the patient is considered cured (Figure 11).

If the treatment of an aneurysm by means of an endovascular approach (coiling) is not possible the aneurysm should be clipped (Figure 12).

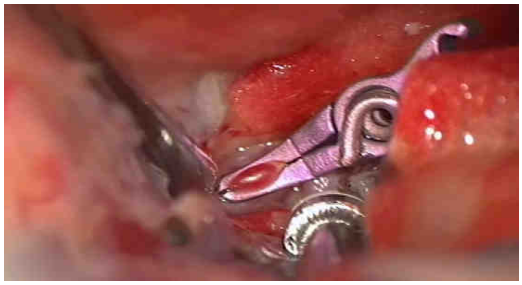

Figure 11 - small 3,5 mm aneurysm clipped

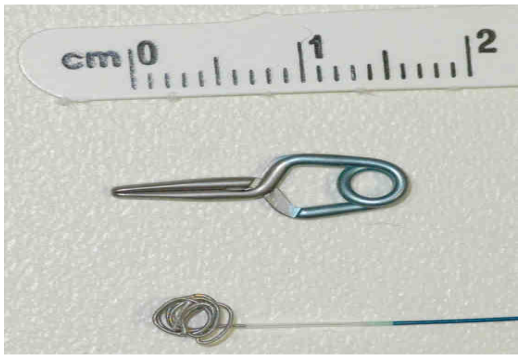

Figure 12 - tools for aneurysms treatment

DOI: 10.1515/romneu-2015-0057

Surgery is a more traditional treatment of cerebral aneurysms which, has proven its effectiveness and safety. The aneurysm is dissected and the neck closed with a titanium clip (Figure 13). Surgery is safe and has a low risk in small aneurysm -5% complication rate.

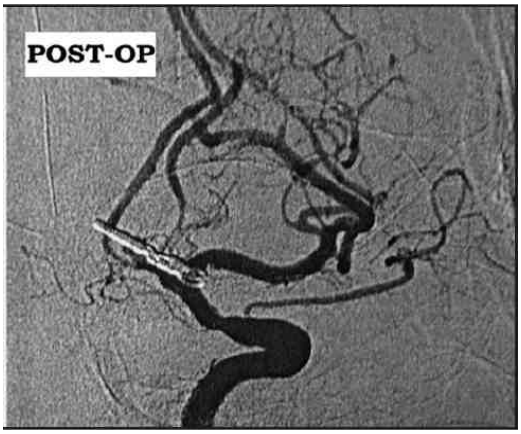

Figure 13 - Postoperative result

For a larger aneurysm or an aneurysm located in an eloquent area or brain stem the risk of the operation is much higher (20 to 30% complication).

A number of 38 cases of total has died. 16 of cases studied, refused treatment.19 of cases are worsening during admittance and have been discharged following families request. Between latest, 3 cases after endovascular treatment and 5 cases after surgery and two cases in which DVE has been installed. In 9 cases any kind of intervention has been applied.

Description of selected 116 cases for the comparative study with subarachnoid hemorrhage (Figure 14).

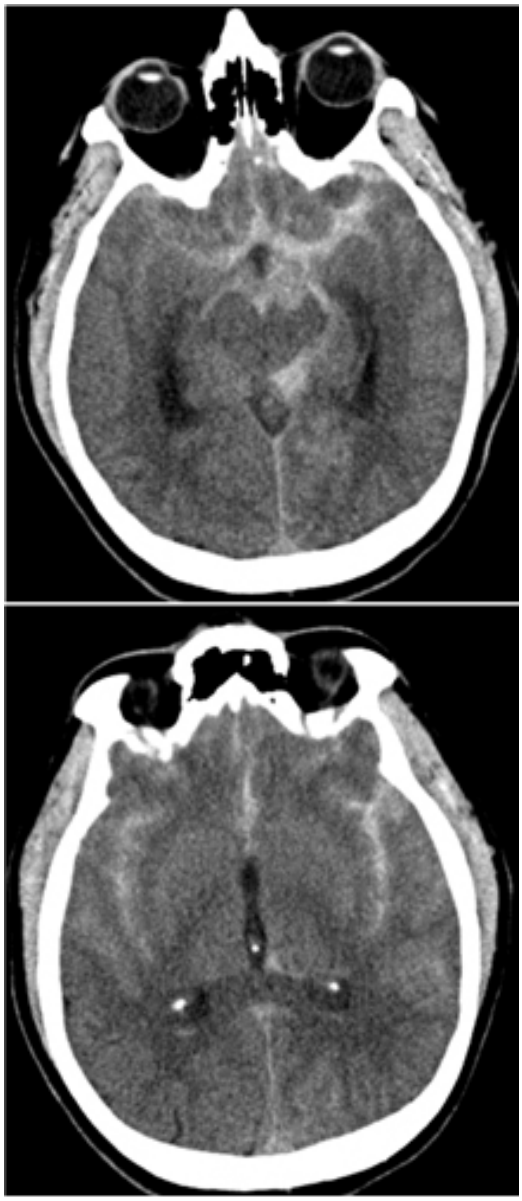

Figure 14 - brain CT showing subarachnoid hemorrhage from a ruptured posterior cerebral artery aneurysm

TABLE 3

A number of 116 cases selected in our study with complete clinical data

Parameter	N=116	
Age (mean years ± SD)	53.1 ± 12.1	AGE 56,5
Sex	68 pac 48 pac	Female 58,3 % male 41,7 %
Hunt and Hess grades		
Grade 1	79 cases	- 68,1 %
Grade 2	15 cases	13 %
Grade 3	5 cases	4,3 %
Grade 4	17 cases	14,65 %
Aneurysms identified	87 cases with aneurvsm -	75% from total.
AcomA	20 cases	23%
MCA	21 cases	24,1%
Ophthalmic artery	4 cases	4,5 %
BA	4cases	4,5 %
PICA	8 cases	9,1 %
ICA	23 cases	26,43%
POST. COM .	3 cases	3,44%
POST.	6 cases	6,89%
Multiple aneurysms	10 cases 3 cases	8,6 % 2,5 % more than 2
Fisher grades		
Grade 1	12 cases	13,79 %
Grade 2	8 cases	9,19%
Grade 3	15 cases	17,24%
Grade 4	26 cases	29,88 %
Hydrocephalus on admission	28 cases	32,18 %
Recurrent hemorrhage	4cases	4,59 %
Surgery	29 cases	33,33%
Coil embolization	23 cases	26,43%
Temporary clipping during surgery	15 cases	17,24 %

ACA = anterior cerebral artery, AcomA = anterior communicating artery, BA = basi- lar artery, MCA = middle cerebral artery, PICA = posterior inferior cerebellar artery, SCA = superior cerebellar artery, SD = standard deviation, VA = vertebral artery. ACI internal carotid, A com Post-post. comm, A cerebrala post - posterior cerebral

Discussions

Aneurysms must be occluded fast in order to make an immediate and aggressive treatment of symptomatic vasospasm to have a proper neurological recovery and prevent infarction.

Intraoperative aneurysm rupture, feeding artery occlusion, cerebral contusion due to brain retraction, intracerebral hematoma evacuation, necessary decompression lobectomy, inexperienced surgeon, are factors for inadequate technical surgery and bad outcome (2, 5, 12). Aneurysm size, location, morphology, calcified necks associate a poor prognosis and postoperative complications, even for patients with a favorable prognosis class. They can also have neuropsychological deficits, cognitive inpairement, after surgery (12, 13).

Special circumstances like patients with advanced age, very young age, posttraumatic or mycotic aneurysms, pregnant women, the

DOI: 10.1515/romneu-2015-0057

association of aneurysms with arteriovenous malformation, fusiform aneurysms or micro aneurysms must be treated with caution.

Surgical concept and decision making:

Interventional endovascular department development, has changed the management of the emergencies with subarachnoid hemorrhage (10, 11).

Unruptered intracranial aneurysm cases diagnosed outside the hospital after preliminary noninvasive investigations change the natural history of aneurysms and course of treatment (8, 9).

In the study carried out (Table 3), 81% rate of all patients underwent cerebral angiography within 24 hours of admission and 30% of patients undergoing endovascular intervention within 48 h of admission. For the decision on microsurgery in the first 48 hours of hospitalization for subarachnoid hemorrhage cases operability percent rising from 2% with an increase between the 5th and the 14th day to 91% of cases. In the remaining 7% of patients, surgery was performed over 14 days.

The serious condition of the patient with subarachnoid hemorrhage requires rapid hospitalization, pace of investigation and decision making timing (14). Aneurysms type and location, angiographicaly confirmed vasospasm with clinical expression, neurological status prior consultation between the surgeon and interventional radiologists will make the decision for individually kind of treatment.

It has been estimated that nearly 3% of the population may develop an aneurysm. At the moment the Angio-MRI can set non-invasive diagnosis of brain aneurysm by population screening (4, 5). As a result one could expect in the coming years, a large number of patients with intracranial aneurysms diagnosed and for that, a decision on the treatment must be taken. To this end, a reliable estimate risk of intracranial aneurysm natural history and treatment risk should be available. Intracranial aneurysms unruptured International Studies (ISUIA) published in 2003 attempted to get light in this field and shows that the cumulative risk over a period of 5 years from a previous ruptured aneurysm Ø <7 mm is 0%.Is this the RIGHT conclusion or is it WRONG?

Patients with subarachnoid hemorrhage are usually in a very serious clinical condition and associate other factors, such as hypertension, diabetes, vascular degenerative diseases, vasospasm and other medical complications (9). This co-morbid changes lead to surgery complications and postoperative sequelae and so, prolonging time for returning to family life and intellectual abilities previously had.

International Studies (ISAT), a randomized trial comparing results of surgery with endovascular interventions in the treatment of aneurysms had been published in The Lancet in 2002. The results showed that the endovascular treatment is less risky (6.9 percent) than open surgery. These results are informative, but they must be interpreted with caution, since the study was the first of its kind and patient follow-up was short, for only one year. Long-term results of endovascular treatment was not yet been established. In terms of open intervention study showed no difference in mortality rate between microneurosurgery and embolization. Therefore, the superiority of one treatment over the other, had no definitive conclusion at that time (10).

A recent study largest, showed that for ruptured aneurysms who have indication for

both, microsurgery and endovascular treatment, patients who underwent endovascular treatment had better results, at least in the short term. (Rate of death or disability at one year is 23.5 percent, compared with 30.9).

How can you decide which procedure is best for a brain aneurysm? The treatment of choice for aneurysms, like all medical decisions should be agreed between doctor and patient. If it is unruptured or ruptured aneurysms, the doctor should discuss the risks and benefits of each treatment option (13). The doctor will usually

recommend one treatment or another, depending on the individual case .Since here we are speaking about small and medium size aneurysms , and all data in this study show that good results can be obtained after accurate surgery we advise this kind of treatment over endovascular procedures especially for emergency cases and a very good selection of cases for unruptered aneurysms.

Conclusions

Although controversy over the best treatment option for some patients remain unresolved both surgical and endovascular treatment options as viable treatment options in the management of cerebral aneurysms today.

Outcome of patients depend largely from team experience. If both departments are available, surgical and endovascular, the patient can benefit from individualized treatment and real chances to be healed.

References

1. Connolly ES Jr, et al. Guidelines for the management of aneurysmal subarachnoid bleeding: A Guide for Health Professionals from the American Heart Association / American StrokE Association. Stroke. Published online 3 May 2012.

2. Morgenstern LB et al. Guidelines for the management of spontaneous intracerebral hemorrhagic. Stroke, 41 (9): 2108 - 2129,2013.

3. Weir B. Unruptured intracranial aneurysms: a review. J Neurosurg.;96:3-42, 2002.

4. Wiebers DO, Whisnant JP, Huston J III, et al, International Study of Unruptured Intracranial Aneurysms Investigators. Unruptured intracranial aneurysms: natural history, clinical outcome, and risks of surgical and endovascular treatment. Lancet; 362: 103-110, 2003

5. Wardlaw JM, White clock. The management of unruptured intracranial aneurysms and recognition. Brain.; 123 (Pt 2): 205-218,2000.

6. S. Takahashi Neurovascular Imaging, MRI & microangiography. Springer Verlag. ISBN: 1848821336th,2010.

7. Wiebers DO, Whisnant JP, Huston et al J. Ruptured intracranial aneurysms: natural history, clinical findings and surgical and endovascular treatment of risks.; 362 (9378): 103-10. Lancet. 2003

8. Makio Kaminogo, Masahiro Yonekura, Shobu Shibata. Incidence and Outcome of Multiple Intracranial Aneurysms in a Defined Population. Stroke;34;16-21,2003

9. Ropper AH, Samuels MA. Cerebrovascular Diseases. In Adams and Victor's Principles of Neurology, 9th ed., Pp. 746-845. New York: McGraw-Hill. 2009

10. Winn HR, MK Rosner, Campbell VA. Youmans Neurological Surgery. 6th edition. Saunders 2011

11. Raaymakers TW, Rinkel GJ, Limburg M, Algra A. Mortality and morbidity of unruptured intracranial aneurysms for surgery: a Meta-analysis. Stroke.; 29 (8): 1531-8, August1998.

12. Quinones-Hinojosa 12 A. Schmidek and Sweet: Operational neurosurgical techniques: Notes 6th edition. Saunders, 2012

13. Choi DS, MC Kim, Lee SK, Willinsky RA, Terbrugge KG.Clinical and angiographic long-term follow-up of completelycoiled Using intracranial aneurysms endovascular technique. J Neurosurg.112 (3): 575-581, March 2010

Ellamushi HE, Grieve JP, Jager HR, Kitchen ND.Risk factors for the formation of multiple intracranial aneurysms. J Neurosurg; 94: 728 –732, 2001