

Diagnosics and treatment of ruptured cerebral aneurysms at the HLUHS Kauno klinikos in 2015 – 2018 year

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ABSTRACT

The aim: To analyze diagnostic and treatment data of ruptured cerebral aneurysms to evaluate the advantages, disadvantages, and effects of the treatment methods on the patient's life expectancy.

Methods: The data of 80 patients, who had a rupture of a cerebral aneurysm, underwent a radiological examination at the HLUHS KK department of Radiology and treatment at the departments of Neurology and Neurosurgery in 2015-2018 were analyzed.

Results: The average age of the patients was $58,36 \pm 13,89$ of women and $53,83 \pm 16,05$ of men. Totally 174 radiological examinations were performed: CT – 41,38%, CT angiography – 41,95%, digital subtraction angiogram – 16,67%. Ruptured aneurysms were most commonly treated using surgical clipping – 65,91%, endovascular embolization – 31,82%, and just a few times conservative treatment was used – 2,27%.

Conclusions: 1. 40-60 years old patients were most commonly diagnosed with a rupture of the anterior communicating artery aneurysm, with no significant difference between genders ($p = 0.256$). 2. The most common short-term symptoms of a ruptured aneurysm were severe headache, nausea, vomiting, unconsciousness, vasospasm, long-term symptoms - biosocial dysfunction, hemiparesis, hemiplegia, disorientation. 3. The primary diagnostic method was CT angiography; if the origin of symptoms was unclear, digital subtraction angiogram was required.

4. The surgical clipping is a dominant method of treatment with a higher risk of postoperative complications, while endovascular treatment has a higher probability of reoperations.

Keywords: cerebral aneurysm, digital subtraction angiogram, CT angiography, endovascular coiling, surgical clipping, subarachnoid hemorrhage.

INTRODUCTION

A cerebral aneurysm is one of the most hazardous pathologies of the brain arteries, which is caused by localized dilatation of the blood vessel. An unruptured aneurysm is clinically silent, sometimes causing headaches, visual changes, double vision, eyelid collapse, an enlarged pupil of one eye. Usually, an intracranial aneurysm is determined by rupture of the sack leading (which leads) to the formation of subarachnoid hemorrhage (SAH). SAH can cause severe symptoms and consequences: sudden headache, nausea, vomiting, neck rigidity, loss of consciousness, seizures, fear of the light, paralysis, and other brain damages, or even death. The incidence of SAH is about 10 to 11

per 100,000 persons per year, with 1,24 times higher risk for females [1]. The typical age of the patient when aneurysm ruptures are more than 50 years. Most of the ruptured aneurysms are more significant than 7mm [2].

CT angiography is the gold standard to diagnose an aneurysm. However, it can be successfully detected using CT, MRT angiography, or digital subtraction angiogram [3]. There are several treatment options: endovascular coiling, surgical clipping, or conservative when the condition of the patient is severe. The standard diagnostic method before surgical treatment is CT angiography, while endovascular treatment requires a digital subtraction angiogram. End-

ovascular treatment is characterized by a less invasive and shorter duration of the procedure, but it is riskier because of the increased chance of repeated bleeding [4-5].

AIM

To analyze diagnostic and treatment data of ruptured cerebral aneurysms to evaluate the advantages, disadvantages, and effects of the treatment methods on the patient's life expectancy.

METHODS

We performed the retrospective observational study at the largest healthcare institution in Lithuania, HLUHS KK, in 2015-2018. Data of 80 patients diagnosed with a ruptured subarachnoid aneurysm based on brain CT, CT angiography, or digital subtraction angiogram. Data about the age and gender of the patients, quantity, size, localization of aneurysms, duration of treatment, and dynamics of symptoms were collected from patients' charts. Patients were grouped by the method of treatment: conservative, endovascular coiling, surgical clipping. Patients' medical histories were chosen randomly. Significance level $p < 0,05$ was chosen.

RESULTS

The study population consisted of 80 patients: 50 (62,5%) were women and 30 (37,5%) men. Age of patients in this group ranged from 24 to 87 years with an average age - $58,36 \pm 13,89$ of women and $53,83 \pm 16,05$ of man. There was no significant age difference between genders ($P=0,206$). Totally 174 radiological examinations were performed: CT - 41,38% (Fig. 1), CT angiography - 41,95% (Fig. 2, Fig. 3, Fig. 4), digital subtraction angiogram - 16,67% (Fig. 5).

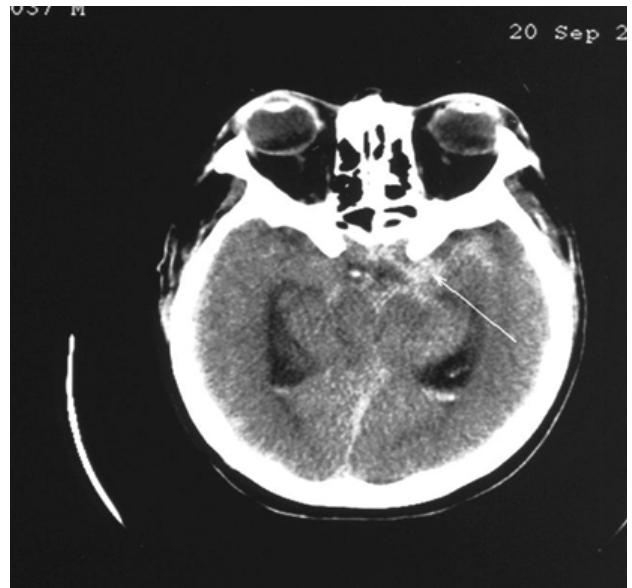


Fig. 1. Simple, non-contrasting brain CT. SAH foundation tanks (white arrow), complicated intraventricular hemorrhage (blue arrow).

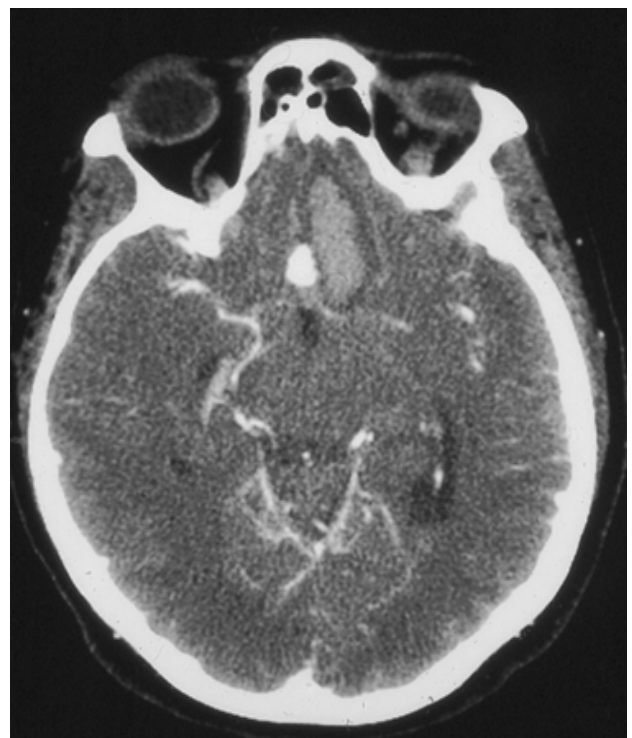


Fig. 2. Cerebral CT angiography, axial projection, unedited (raw) image. Contrast media in arteries (thin black arrow), contrast media in the aneurysm (blue arrow). Bleeding into the brain near the aneurysm sac (thick black arrow).

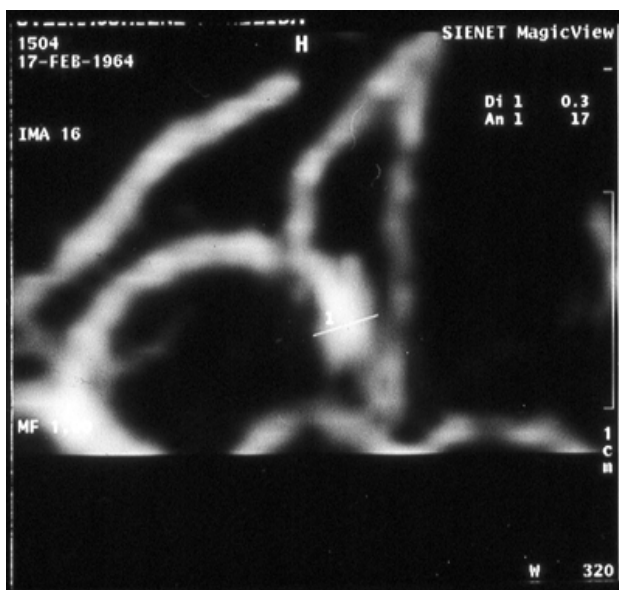


Fig. 3. Brain CT angiography 3D reconstruction with MIP (maximum intensity pixels). Aneurysm of the anterior communicating artery (grey arrow).

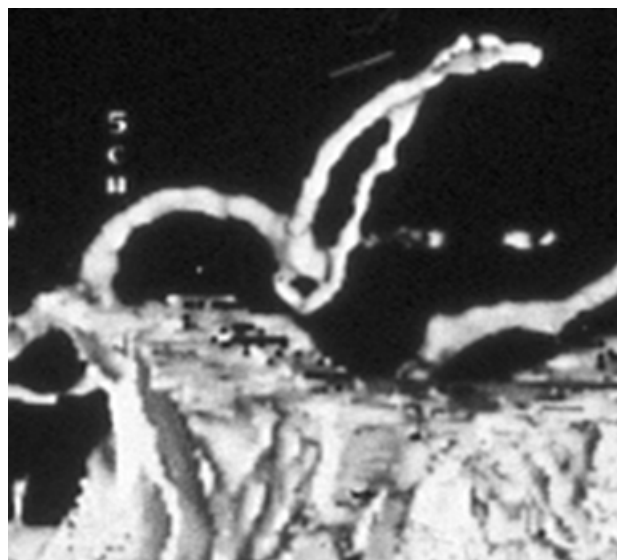


Fig. 4. Brain CT angiography 3D reconstruction in SSD (surface shaded display). Aneurysm of the anterior communicating artery (blue arrow).



Fig. 5. Brain digital subtraction angiogram. Aneurysm of the anterior communicating artery (blue arrow).

The diagnosis was based on CT and CT angiography for 63,75% patients, digital subtraction angiogram – 7,5%, CT angiography, and digital subtraction angiogram – 28,75%. Patients were diagnosed with 94 intracranial aneurysms, of which 85 were ruptured. In a total of 80 patients, 13 cases (16,25%) had multiple aneurysms: 12 patients had two aneurysms, for three patients

both were ruptured, one patient had three aneurysms (1 ruptured). The most frequent localizations of ruptured aneurysms were: anterior communicating artery – 32,96%, right and left middle cerebral artery distributed into 26,38 % and 20,89 %, right and left internal carotid artery – 11 % and 3,33 % (Table 1), there was no significant difference between the genders ($P = 0.068$).

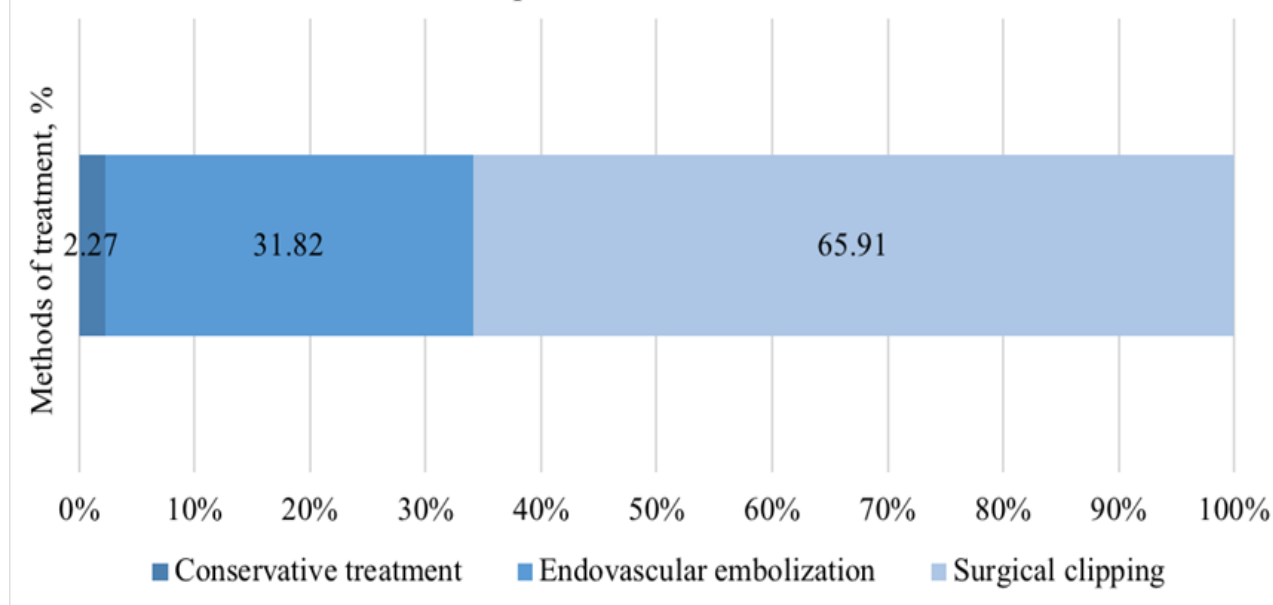
Table 1. Distribution of aneurysms' localization

Localization of aneurysms	Distribution among male (%)	Distribution among female (%)
ACoA	15,38	17,58
MCA (right)	14,29	12,09
MCA (left)	3,31	17,58
ICA (right)	1,11	9,89
ICA (left)	1,11	2,22
Ach (left)	-	1,11
BA	-	2,22
VA (left)	1,11	-
PICA	-	1,11
Total	36,2	63,8

Here: - ACoA – anterior communicating artery, MCA - middle cerebral artery, ICA - internal carotid artery, Ach – anterior choroidal artery, BA - basilar artery, VA – vertebral artery, PICA – posterior inferior cerebellar artery.

During the study, the mean cerebral aneurysm size was detected 8,6x7,52mm (minimum – 0,6x0,7mm, maximum - 35x45mm). According to our research, ruptured aneurysms were most commonly treated using surgical clipping – 65,91%, endovascular embolization – 31,82%, and just a few times conservative treatments were used – 2,27% (Fig. 6).

Fig. 6. Distribution of performed treatment methods



Repeated endovascular coiling was performed for 3,41% of patients, coiling after surgical clipping for 2,27% patients, and 4,55% of patients underwent surgical clipping after coiling. The average duration of endovascular coiling was 65,23 min, and the surgical clipping - 220,45 min. Postoperative complications occurred for 10,13% of patients and were 1,67 times more frequent after surgical clipping. Analyzing dynamic of symptoms after treatment, positive condition

occurred to 56,25% of patients (for 71,1% clipping was performed), negative – 37,5% (of which 26,67% died), and there was no significant change of condition to 6,25% patients. According to our study, in many cases short-term symptoms were (Fig. 7): headache (72,5%), nausea (45%), vomiting (30%), unconscious (32,5%), vasospasm (8,75%); long-term symptoms (Fig. 8): biosocial dysfunction (7,5%), hemiparesis (7,5%), hemiplegia (6,25%), disorientation (7,5%),

Fig. 7. Distribution of short-term symptoms by frequency

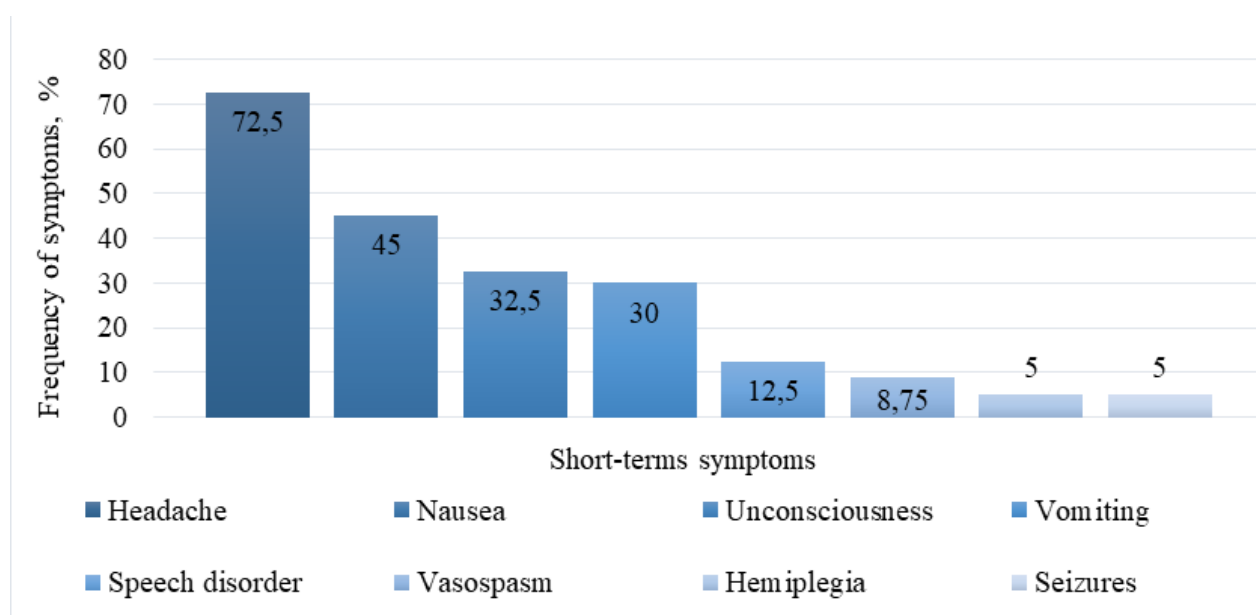
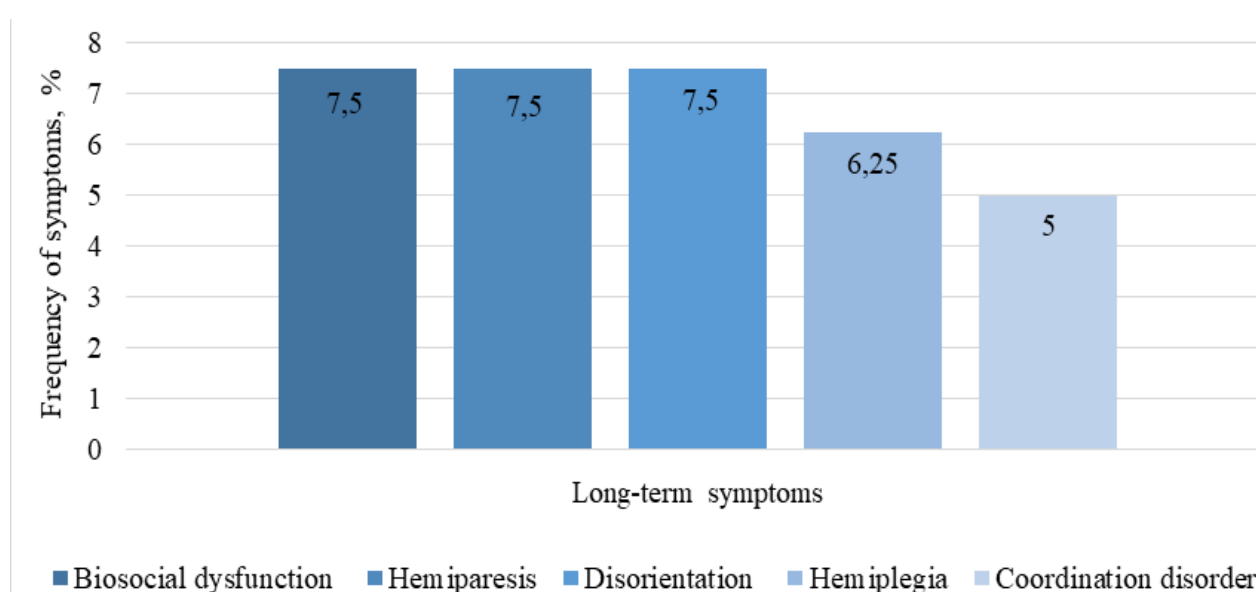


Fig. 8. Distribution of long-term symptoms by frequency



DISCUSSION

The study group consisted of 80 patients, who had a rupture of a cerebral aneurysm, underwent a radiological examination at the HLUHS CK Radiology Clinic and treatment at Neurology and Neurosurgery Clinic in 2015-2018. The age of patients in this population ranged from 24 to 84 years, with an average age of $58,36 \pm 13,89$ in women and $53,83 \pm 16,05$ in man. Relatively, the similar average age of patients (50-59 years) is also indicated in literature sources [6-8]. In our study, the average size of the ruptured aneurysm was $8,6 \times 7,52$ mm. Similar results were obtained during the studies of other studies, whose average size was 5-10 mm [4,5]. To our knowledge, the most common localizations of aneurysms were: ACoA – 34,04%, right and left MCA distributed into 25,53% and 20,21 %, right and left ICA – 11,70% and 3,19%, comparable results were recorded in other studies [6-8]. According to our findings, it became evident that multiple aneurysms were spotted in 16,25% of cases. The similar results were found in other research (multiple aneurysms were detected for 14.57% patients) [6]. Our study shows that CT angiography is the gold standard for ruptured aneurysms examination before choosing treatment, although the meta-analysis of E. Thomas Chappell and co-authors suggests, that digital subtraction angiogram is the standard method, but specialists who use CTA says that this method is good or even better than digital subtraction angiogram in the diagnosis and treatment of cerebral aneurysms [9]. During the study, we found that the most common short-term symptoms were headache, nausea, vomiting, unconscious, vasospasm. Most frequent long-term symptoms were biosocial dysfunction, hemiparesis, hemiplegia, disorientation, similar results were obtained in a study, conducted in the Philadelphia, where was found that SAH survivors had increased problems in the quality of life: mobility, self-care, usual activities, and anxiety/depression [10]. In our study, we found that endovascular coiling results in fewer poor clinical outcomes comparing with surgical clipping. Relatively, Cameron G. McDougall and co-authors in a study, conducted in California, estimated that coiling results in fewer

er complications, thus not all aneurysms should be treated by coil embolization [11]. Having reviewed the results of our and previous studies, as well as the literature data, we can observe that diagnostic, treatment, and outcomes of ruptured cerebral aneurysms, which cause SAH, are quite similar.

CONCLUSIONS

1. 40-60 years old patients were most commonly diagnosed with a rupture of anterior communicating artery aneurysm, with no significant difference between genders ($p = 0.256$).
2. The most common short-term symptoms of a ruptured aneurysm were severe headache, nausea, vomiting, unconsciousness, vasospasm, long-term symptoms - biosocial dysfunction, hemiparesis, hemiplegia, disorientation.
3. The primary diagnostic method was CT angiography; if the origin of symptoms was unclear, digital subtraction angiogram was required.
4. The surgical clipping is a dominant method of treatment with a higher risk of postoperative complications, while endovascular treatment has a higher probability of reoperations.

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