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Health Assessment of Patients with Cerebral Unruptured Aneurysms After Applying Interventional Therapy

Ocena stanu zdrowia pacjentów z niepękniętymi tętniakami mózgu po zastosowaniu terapii interwencyjnej

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Abstract

Introduction. The incidence of intracranial aneurysms in the human population is determined on 15–20 at 100 thousands residents. In any case, brain aneurysm, the basis for optimal therapy and satisfactory results of treatment is early diagnosis allowing for rapid implementation specified by the patient procedure.
Aim. The aim of this study is to assess the health status of patients with brain aneurysms not cracked after the application of interventional therapy.
Material and Methods. The study included 20 patients diagnosed with ruptured brain is not under investigation by an intervention, hospitalized in 2011 in the Department of Neurosurgery USK in Bialystok. An analysis of medical records.
Results. The study included 14 (70%) women and 6 (30%) men with unruptured brain undergoing interventional procedure. The mean age was 53.35±8.68 years (69–37 years). Aneurysm of the most 9 (45.0%) was located in the anterior communicating artery. The average hospital stay was 6.92± women 2.90 days (4–12 days) and 5.20± men 1.64 days (4–8 days) (NS). Frequently performed the test in the diagnosis of cerebral aneurysm was computed tomography, and the symptoms were headache (15, 78.7%) and syncope (3, 15.8%). Embolization was performed in (14, 70.0%) and was usually embolization aneurysm located on the internal carotid artery (5, 83.3%). No significant differences were observed with respect to the location of the aneurysm and the parameters before and after surgery. The average period of hospitalization was significantly longer in patients undergoing craniotomy (10.00±2.160 days) than embolization (5.43±1.828 days) (p=0.006).
Conclusions.
1. Unruptured aneurysms of the brain were more common among women, and computed tomography was the most commonly performed diagnostic test.
2. The most common symptom of an aneurysm among women was headache, and among men fainting.
3. The most common surgical intervention was embolectomy, and hospitalization was held in elective surgery.
4. After surgery, a person with hypertension and tobacco smokers had a higher heart rate, systolic blood pressure and a shorter duration of hospitalization. In contrast, patients with headache as a symptom of an aneurysm, were hospitalized longer and had accelerated heart rate after surgery. **(JNNN 2014;3(1):15–24)**

Key Words: not cracked brain aneurysm, runaway operating health

Streszczenie

Wprowadzenie. Częstość występowania tętniaków śródczaszkowych w populacji ludzkiej określa się na 15–20 na 100 tys. mieszkańców. W każdym przypadku tętniaka mózgu podstawą optymalnej terapii i uzyskania zadowalających wyników leczenia jest wczesne rozpoznanie, pozwalające na szybkie wdrożenie określonego przez stan pacjenta postępowania.
Cel. Celem pracy jest ocena stanu zdrowia pacjentów z niepękniętymi tętniakami mózgu po zastosowaniu terapii interwencyjnej.

Materiał i metody. Badaniem objęto 20 pacjentów z rozpoznanym niepękniętym tętniakiem mózgu poddanych postępowaniu interwencyjnemu, hospitalizowanymi w 2011 r. w Klinice Neurochirurgii USK w Białymstoku. Dokonano analizy dokumentacji lekarskiej.
Wyniki. Badaniem objęto 14 (70%) kobiet i 6 (30%) mężczyzn z niepękniętym tętniakiem mózgu poddanych postępowaniu interwencyjnemu. Średni wiek badanych wynosił 53,35±8,68 lat (69–37 lat). Tętniak najczęściej 9 (45,0%) umiejscowiony był w tętnicy łączącej przedniej. Średni okres hospitalizacji kobiet wynosił 6,92±2,90 dni (4–12 dni) a mężczyzn 5,20±1,64 dni (4–8 dni) (NS). Najczęściej wykonywanym badaniem w diagnostyce tętniaka mózgu była tomografia komputerowa, a objawami był ból głowy (15;78,7%) i omdlenie (3;15,8%). Embolizację wykonano u (14;70,0%) osób, a embolizowany najczęściej był tętniak umiejscowiony na tętnicy szyjnej wewnętrznej (5;83,3%). Nie zaobserwowano istotnych różnic w odniesieniu do umiejscowienia tętniaka a parametrami przed i po zabiegu operacyjnym. Średni okres hospitalizacji był istotnie dłuższy u osób poddanych zabiegowi kraniotomii (10,00±2,160 dni) niż embolizacji (5,43±1,828 dni) (p=0,006).
Wnioski.
1. Niepęknięte tętniaki mózgu występowały częściej wśród kobiet, a tomografia komputerowa była najczęściej wykonywanym badaniem diagnostycznym.
2. Najczęściej występującym objawem tętniaka wśród kobiet był ból głowy, a wśród mężczyzn omdlenia.
3. Najczęściej stosowanym rodzajem interwencji chirurgicznej była embolektomia, a hospitalizacja odbyła się w trybie planowym.
4. Po zabiegu operacyjnym osoby z nadciśnieniem tętniczym i palące tytoń miały wyższe tętno, ciśnienie tętnicze skurczowe i krótszy okres hospitalizacji. Natomiast pacjenci z bólem głowy jako objawem tętniaka, byli dłużej hospitalizowani i mieli przyśpieszoną akcję serca po zabiegu operacyjnym. **(PNN 2014;3(1):15–24)**
Słowa kluczowe: niepęknięty tętniak mózgu, zbieg operacyjny, stan zdrowia

Introduction

Aneurysms constitute the most common cerebrovascular defect of the brain. They usually occur at the division of stem vessel into next branches or in the place where each artery departs. The cerebral aneurysm may appear at any age, however it is most often diagnosed at the approximate age from 30–60 slightly more frequently in women. With patients under 40, suffering from the cerebral aneurysm these pathologies occur more often in women than in men and the proportion is 3:2 whereas with those over 40 the situation is the opposite [1,2]. The incidence of cerebral aneurysms is not precisely known. According to various studies their occurrence is estimated to be in 0.2–7.9% of human population [1,3]. In 85% of cases, aneurysms are located in the front part of the brain arterial circle (Willis's). Most of them occur on the communicating artery (35%), then on the middle cerebral artery (20%) at the division of the carotid artery (8–12%) in the further section of the anterior cerebral artery (3–5%) the anterior choroidal artery (3%) and ophthalmic artery (2%). A significant percentage of aneurysms, up to 30% occur on the internal carotid artery within the intracranial section. Aneurysms of the internal carotid artery division regard approximately 5–7% of intracranial aneurysms [3,4]. In the female group aneurysms are more often located on the internal carotid artery whereas in the male group on the anterior communicating artery.

Most often the changes are observed in the shape of the aneurismal sac (saccular aneurysm), which is linked with the maternal vessel by mean of a stalk. The less common types of intracranial aneurysms include: fusiform, traumatic or military aneurysms [1].

Aneurysms on intracranial aneurysm may increase their diameter, be the reason for dangerous bleeding or trigger pressure symptoms [5]. The highest risk of aneurysm rupture occurs at the moment when it achieves the diameter of 3–5 mm. Among aneurysms with the diameter of 3–5 mm, 25% of them rapture. Aneurysms with the diameter larger than 20 mm bleed more rarely because they are covered inside with thrombus, as well those which are smaller than 2 mm [6,7]. Unfortunately, most cerebral aneurysms are discovered only after their rapture. In approximately 10% of patients the cerebral aneurysms is discovered before its rapture, including 3% discovered by coincidence or in the case of larger aneurysms due to symptoms resulting from pressure on brain structures 7%. If the cerebral aneurysm is found and it is still not ruptured, the decision determining further actions is quite complex. However each case of the cerebral aneurysm should be treated individually, taking into account the patient's age, complaints, as well as the aneurysm location and shape. Adopting appropriate method of surgery as well as intensified conservative acting before and after the surgery allow for quick recovery and limiting remote consequences of bleeding. Only the entirety can affect the decision whether the aneurysm should be treated or continued to be only observed [8]. Clinic symptoms are expressed in various ways and depend above all on the aneurysm location and are related mainly to large aneurysms [1,2].

The main aim of this study is to assess health conditions of patients with cerebral aneurysm not ruptured after applying interventional therapy. Another purpose of this study is to:

1. Characterise the frequency of occurrence, its location, types of symptoms and parameters in patients with not ruptured cerebral aneurysm.
2. Determine the effect of the interventional therapy applied on the patient's condition as well as on prognosis.

Material and Methods

In the retrospective study there were included patients diagnosed with brain not ruptured aneurysm, who had undergone interventional procedure, hospitalized in 2011 in the Department of Neurosurgery USK in Bialystok.

The research was carried out based on the medical documentation. The applied type of the interventional procedure as well as the factors of aneurysm risk were analysed (hypertension, smoking, overuse of alcohol and drugs (cocaine). The analysis also included the parameters determined at the acceptance and discharge from hospital; glucose, hemoglobin, hematocrit concentration, blood pressure, pulse rate and state of consciousness according to the Glasgow Scale.

The results obtained were subject to a statistical analysis. The relationships between quality variable were evaluated using Fisher's precise test or Fisher-Freeman-Halton test (in cases where the number of quality variables variants exceeds 2), for the calculation of which the Microsoft Exel application was used. All statistical hypotheses were verified at the level of significance p=0.05.

Results

The study covered 20 patients diagnosed with brain not ruptured aneurysm subject to interventional procedure including 14 (70%) women and 6 (30%) men. The average age of the patients was 53.35±8.68 years (69–37 years). The average age of the women tested was 53.50±8.99 years (37–69 years), and in the case of men it was 53.00±8.71 years (45–69 years) NS. The aneurysm was most often 9 (45.0%) located in the anterior communicating artery. Table 1.

The oldest were the patients with the aneurysm on the left Internal carotid artery (58.17±8.28 years), and the youngest with the aneurysym on the right Internal carotid artery (48.00±6.519 years). Whereas the age of patients with the aneurysym located on the anterior communicating artery was 53.11±8.92 years.

Table 1. The location of the aneurysm and sex of the patients tested

			Sex		Total
			women	men	
Location of the aneurysm	internal carotid artery right	n	4	1	5
		%	28.6	16.7	25.0
	internal carotid artery left	n	4	2	6
		%	28.6	33.3	30.0
	anterior communicating artery or other	n	6	3	9
		%	42.9	50.0	45.0
Total		n	14	6	20
		%	100.0	100.0	100.0

The average heart rate at the acceptance — with women was 74.00±10.318 u/min, and in the male group it was 72.50±10.766 u/min (NS). The average value of systolic blood pressure at acceptance — with women was 137.07±23.226 mmHg, and in the male group 134.17±11.286 mmHg (NS). The average value of diastolic blood pressure at acceptance — with women was 75.14±10.287 mmHg, and in the male group 79.83±8.110 mmHg (NS). The average hospitalization period for women was 6.92±2.90 days (4–12 days) and for men 5.20±1.64 days (4–8 days) (NS).

The average hospitalization period for patients with the aneurysm on the right internal carotid artery was 7.00±3.391 days, and for the patients with the aneurysm located on the anterior communicating artery was 7.29±2.928 days. The shortest period of hospitalization was in the case of patients with the aneurysm of the left internal carotid artery (5.00±1.09 days) (NS).

The most commonly applied test in the diagnosis of the cerebral aneurysm was computed tomography. It was performed with 3 patients (20.0%) with the aneurysm on the right internal carotid artery, 6 (40.0%) with the aneurysm on the right internal carotid artery and 6 (40.0%) patients with the aneurysm on the anterior communicating artery or other location. Whereas angiography for the diagnostic purpose was carried out in the case of one person with the cerebral aneurysm (NS).

Hypertension was in 7 (35.0%) patients including 4 (57.1%) with the aneurysm of anterior communicating artery or another, 2 (28.6%) with the aneurism of the left internal carotid artery and 1 (14.3%) with the aneurism of the right internal carotid artery. There was no statistical significance found between the location of the aneurysm and hypertension occurrence.

The vast majority (11;55.0%) of patients with not ruptured aneurysm were smokers. This group included 5 patients (45.5%) with the aneurysm of the anterior communicating artery and 3 (27.3%) with the aneurysm

of the left and 3 of the right internal carotid artery. There was no statistical significance found in the tested group between the location of the aneurysm and smoking.

Only one person (5%) with the aneurysm located in the left internal carotid artery overused alcohol.

Headache as an aneurysm syndrome occurred in 15;78.7% of the tested, including 12 women (87.7%) and 3 men (60.0%). It occurred in 6 (85.7%) persons with hypertension (NS), 6 persons (75.0%) with the aneurysm of anterior communicating artery, 5 persons (83.3%) with the aneurysm of the left internal carotid artery and 4 persons (80%) with the aneurysm of the right internal carotid artery (NS).

Fainting as a cerebral aneurysm syndrome occurred only in 3 patients (15.8%). Most often in patients with anterior communicating artery aneurysm (2;25.0%) and in one with the aneurysm of the right internal carotid artery (NS). Fainting as a cerebral aneurysm occurred in 2 women (14.3%) and in 1 man (20.0%) (NS).

The most often performed surgical intervention in the treatment of not ruptured cerebral aneurysms was embolization (14;70.0%). It was carried out in the case of 5 men (64.3%) and 9 women (83.%), compared to 4 (20.0%) of craniotomy combied with clippimg (0;0.0% vs 4;28.6%) and 2 (10.0%) of craniotomy (1;16.7% vs 2;7.1%) (NS). Table 2.

Table 2. Type of surgical intervention and gender of patients

			Sex		Total	P
			women	men		
Type of surgical intervention	embolization	n	9	5	14	0.308
		%	64.3	83.3	70.0	
	craniotomy	n	1	1	2	
		%	7.1	16.7	10.0	
	craniotomy +clipping	n	4	0	4	
		%	28.6	0.0	20.0	
	Total	n	14	6	20	
		%	100.0	100.0	100.0	

Embolized was most often the aneurysm located in the internal carotid artery (5;83.3%) in reference to the craniotomy surgery combined with clipping (1;16.7%), craniotomy. As regards aneurysms located in the anterior communicating artery, there were performed 5 (55.6%) embolizations, 2 (22.2%) craniotomies and 2 (22.2%) craniotomies combined with clipping. The embolization method was applied in the case of 4 (80.0%) patients with internal carotid artery whereas craniotomy with clipping was performed in 1 person (20.0%). In the scheduled mode there were carried out 13 (76.5%) embolizations, 2 (11.8%) craniotomies with clipping of the cerebral aneurysm. Whereas in the mode of urgency there were carried out 1 (33.3%) embolization and 2 (66.7%) craniotomies with the aneurysm clipping). There was no statistical significance found between the type of surgical intervention and the location of the aneurysm or the mode of performing the surgery.

The average value of hemoglobin (13.683±1.77 vs 12.029±1.27 g/dl; p=0.008), hematocrit (41.350±2.68 compared to 35.993±3.87%; p=0.021) and creatinine (1.06±0.30 compared to 0.78±0.07 mg/dl p=0.011) before the surgery in the male group was significantly higher than in the female group. There was no statistical significance found between the number of points in the Glasgow scale obtained before the operation, glucose and creatinine as well as the patients' sex. Table 3.

The research included 9 patients (45.5) with the aneurysm of the anterior communicating artery or another, 6 (30.0%) with the aneurysm in the left internal carotid artery and 5 (25%) with the aneurysm in the right internal carotid artery. There was no statistical significance found regarding the aneurysm location and the pre-operation parameters, which is presented in Table 4.

Only in the group of patients with hypertension the value of systolic pressure was statistically significantly higher compared to those without the co-existing hypertension (154.71±20.29 vs 126.23±11.26 mmHg; p=0.006). The remaining parameters did not differ significantly in reference to the existing hypertension (Table 5).

Only the average heart rate before the surgery in non-smokers was slightly higher (78.11±11.01 s/min) than in the case of smokers (69.82±8.13 s/min) (p=0.056). The remaining analysed parameters did not differ as regards smoking, they are presented in Table 6.

In the group of patients where embolization was to be performed, compared to patients which were to undergo craniotomy, the average values of hematocrit before the surgery (14.85±0.555 vs. 11.483±1.129 g/dl) (p=0.039) and hemoglobin (34.517±3.699 vs. 38.921 ±3.943%) were significantly higher (p=0.017). There was no statistical significance found between the type of the surgery proposed and the value of heart rate, blood pressure, hemoglobin, hematocrit, glucose and the amount of points according to the Glasgow Scale before the surgery (Table 7).

There was no statistical significance found regarding the aneurysm location, and the parameters of life and the number of complex spirals which is illustrated in Table 8.

Average heart rate in patients after embolization of the aneurysm was significantly higher than with those after craniotomy performed (72.21±7.245 vs. 64.33±6.976 u/min; p=0.034). Whereas the average period of hospitalization was significantly longer with patients who had undergone the craniotomy surgery (10.00±2.160 days) than embolization (5.43±1.828 days) (p=0.006). There was no statistical significance found between the

Table 3. Sex and the parameters before the surgery

Sex		Before the surgery: GCS (points)	HB (g/dl)	HCT (%)	Glucose (mg/dl)	Creatinine (mg/dl)
Women N=14	M/SD	14.85±0.55	12.029±1.27	35.993±3.87	106.09±32.42	0.78±0.07
	Min	13	9.8	30.6	84	0.6
	Max	15	13.7	41.1	197	1.02
Men N=6	M/SD	15.00±0.00	13.683±1.77	41.350±2.68	111.17±37.29	1.06±0.30
	Min	15	12.5	37.4	86	0.71
	Max	15	14.5	44.2	186	0.94
p (Mann-Whitney test)		0.497	0.008	0.021	0.762	0.011

Table 4. The location of the aneurysm and the parameters before the surgery

Location of the aneurysm		Before the surgery: HR (u/min)	RR systolic (mmhg)	RR diastolic (mmhg)	GCS (points)	HB (g/dl)	HCT (%)	Glucose (mg/dl)
Internal carotid artery right N=5	M/SD	72.00±15.03	136.80±11.71	81.60±3.50	15.00±0.00	12.06±1.633	37.08±5.35	94.25±9.179
	Min	58	128	78	15	9.8	30.8	84
	Max	94	156	87	15	13.6	43.2	102
Internal carotid artery left N=6	M/SD	72.33±10.89	132.67±26.37	71.67±8.95	15.00±0.00	13.55±568	40.11±2.138	109.33±37.79
	Min	55	110	60	15	13.0	36.9	90
	Max	82	184	82	15	14.5	43.5	186
Anterior communicating artery N=9	M/SD	75.22±7.32	138.22±21.04	77.00±11.58	14.75±707	12.10±1.341	36.21±4.443	114.43±38.98
	Min	61	102	55	13	10.1	30.6	86
	Max	85	173	90	15	14.5	44.2	197
p (Kruskal--Wallis test)		0.842	0.461	0.212	0.503	0.068	0.284	0.659

Table 5. The occurrence of hypertension and the parameters before the surgery

Hypertension		Before the surgery: Age (years)	HR (u/min)	RR systolic (mmhg)	RR diastolic (mmhg)	GCS (points)	HB (g/dl)	Glucose (mg/dl)
No	n	13	13	13	13	12	13	12
	M/SD	53.62±9.76	73.46±11.42	126.23±11.26	76.00±10.69	15.00±0.00	12.52±1.483	110.5±38.69
	Min	37	55	102	55	15	9.8	84
	Max	69	94	140	90	15	14.5	197
Yes	n	7	7	7	7	7	7	5
	M/SD	52.86±6.89	73.71±8.22	154.71±20.29	77.57±8.30	14.71±7.56	12.52±1.243	101.6±14.29
	Min	44	61	129	64	13	10.1	90
	Max	63	82	184	89	15	13.8	125
p (Mann--Whitney test)		0.905	1.000	0.006	0.905	0.190	0.937	0.832

Table 6. Smoking and the parameters before the surgery

Before the surgery								
Smoking		Age (years)	HR (u/min)	RR systolic (mmhg)	RR diastolic (mmhg)	GCS (points)	HB (g/dl)	Glucose (mg/dl)
No	n	9	9	9	9	9	9	7
	M/SD	51.11±10.68	78.11±11.01	129.33±14.28	76.22±8.61	15.00±0.0	12.356±1.84	122.29±47.76
	Min	37	55	102	55	15	9.8	86
	Max	69	94	157	82	15	14.5	197
Yes	n	11	11	11	11	10	11	10
	M/SD	55.18±6.61	69.82±8.13	141.82±22.98	76.82±10.96	14.80±0.632	12.664±8.97	97.80±12.51
	Min	45	58	110	60	13	10.9	84
	Max	69	80	184	90	15	13.7	125
p (Mann-Whitney test)		0.183	0.056	0.268	0.675	0.343	0.879	0.432

Table 7. Type of surgical intervention and the parameters before the surgery

Before the surgery										
Type of surgical intervention		Age (years)	HR (u/min)	RR systolic (mmhg)	RR diastolic (mmhg)	GCS (pkt)	HB (g/dl)	HCT (%)	Na (mmol/l)	Glucose (mg/dl)
Embolization	n	14	14	14	14	13	14	14	14	13
	M/SD	54.79 ±9.04	73.57 ±10.96	134.71 ±16.78	78.00 ±9.487	14.85 ±0.555	12.971 ±1.241	38.921 ±3.943	138.50 ±1.871	105.6 ±26.37
	Min	37	55	110	60	13	9.8	30.8	135	86
	Max	69	94	173	90	15	14.5	44.2	141	186
Craniotomia	n	6	6	6	6	6	6	6	6	4
	M/SD	50.00 ±7.40	73.50 ±9.05	139.67 ±28.00	73.17 ±10.284	15.00 ±0.000	11.483 ±1.129	34.517 ±3.699	137.33 ±3.141	115.25 ±54.57
	Min	43	60	102	55	15	10.1	30.6	133	84
	Max	60	85	184	84	15	13.1	40.5	141	197
p (Mann-Whitney test)		0.200	0.740	0.649	0.264	0.497	0.017	0.039	0.558	0.362

Table 8. The location of the aneurysm and the parameters after the surgery

After the surgery						
Location of the aneurysm		HR (u/min)	RR systolic (mmhg)	RR diastolic (mmhg)	GCS (points)	Number of spirals
Internal carotid artery right	n	5	5	5	5	4
	M/SD	70.80±12.153	126.40±5.413	79.60±5.505	15.00±0.000	4.50±1.915
	Min	55	120	70	15	2
	Max	74.00	130.00	82.00	15.00	5.00
Internal carotid artery left	n	6	6	6	6	5
	M/SD	70.17±4.750	120.33±12.660	71.33±10.424	15.00±0.000	5.20±2.387
	Min	64	100	62	15	2
	Max	75	133	90	15	8
Anterior communicating artery and others	n	9	9	9	8	5
	M/SD	69.11±7.688	129.67±15.223	80.67±6.461	14.75±0.707	6.20±0.447
	Min	56	104	69	13	6
	Max	76	149	90	15	7
p (Kruskal-Wallis test)		0.927	0.284	0.111	0.503	0.364

Table 9. A surgical type parameters after surgery

Type of surgical intervention		After the surgery				
		HR (u/min)	RR systolic (mmHg)	RR diastolic (mmhg)	GCS (points)	Hospitalisation period (days)
Embolization	n	14	14	14	13	14
	M/SD	72.21±7.245	125.29±11.848	76.86±7.492	14.85±0.63	5.43±1.828
	Min	55	100	62	13	4
	Max	85	140	90	15	9
Craniotomy	n	6	6	6	6	4
	M/SD	64.33±6.976	127.83±15.715	79.33±10.801	15.00±0.00	10.00±2.160
	Min	56	104	64	15	7
	Max	74	149	90	15	12
p (Mann-Whitney test)		0.034	1.000	0.479	0.497	0.006

type of the burgery intervention applied and the value of arterial blood pressure and the number of points according to Glasgow Scale after the operation (Table 9).

Discussion

Location of aneurysms is closely related to the intensified activity of blood current, therefore, they are most often encountered in the place of brain artery division. According to Kwiatkowska's study the most often encountered aneurysms are located on: the middle cerebral artery (41%) internal carotid artery (24%), anterior communicating artery (23%), anterior cerebral artery (8%) and posterior cerebral artery (2%) [9]. The research carried out at the Department and Neurosurgery Clinic in Poznan showed that most aneurysms were located on the middle cerebral artery (43.7%), anterior communicating artery (26.8%), internal carotid artery (1.9%), anterior cerebral artery (5.6%), posterior communicating artery (4.2%). In individual cases, on the ophthalmic and the basilar artery [10]. In our research the aneurysm was most often located on the anterior communicating artery or another (9;45.0%), the left internal carotid artery (6;30.0%) and the right internal carotid artery (5;25.0%). A similar location of aneurysm is presented by Brown, the anterior part of Wills arterial circle was the most frequent location of aneurysms on: the anterior communicating artery (21–38%), internal carotid artery (24–34%), middle (17–21%), basilar artery (10%), posterior cerebral artery (10%) [11].

Świętaszczyk and partners determined the following factors which may be responsible for the occurrence of cerebral artery aneurysms: genetic factor, changes in hemodynamics of cerebral circulation as well as exogenous factors such as hypertension, smoking, alcoholism and atherosclerosis, to mention the most common [1]. Unbalanced location of aneurysms could indicate acquired causes although the congenital ones cannot be excluded. Other authors claim that the formation of aneurysms risk factors include: hypertension, smoking, alcohol abuse, collagen diseases, polycystic kidney disease, arterial malformations of the cerebral arterial circle, such as asymmetry, narrowing of the arteries [12]. Among the patients in the Department and Clinic of Neurosurgery in Poznan 30% patients suffered from hypertension [10]. Among the patients with not ruptured aneurysm, 7 (35.0%) patients suffered from hypertension, including 4 patients (57.1%) with aneurysm of the anterior communicating artery or another, 2 (28.6%) patients with the aneurysm of the left internal carotid artery and 1 (14.3%) patient with the aneurysm of the right internal carotid artery. However, the majority of patients covered by the research (11;55.0%) patients not ruptured aneurysm smoked. This group included 5 (45.5%) patients with aneurysm of the anterior communicating artery, 3 (27.3%) patients with the aneurysm of the right and 3 of the left internal carotid artery.

Among the patients operated on in the Department and Clinic of Neurosurgery in Poznań there were 61.3% women and 38.7% men [10]. Also, in research carried out by Dopierała women constituted a bigger group than men (59.1% vs. 50.9%). In the tested group 59.1% (26 patients) were women, and 41,9% were men [13]. In our research the aneurysm of the right internal carotid artery occurred in 28.6% of women and 16.7% of men, the aneurysm of the left internal carotid artery occurred in 28.6% of women and 33.3% of men, Whereas the aneurysm of the anterior communicating artery or another in 42.9% of women and 50.0% of men.

A lot of authors say that the worst effect of the aneurysm presence on the cerebral artery is the aneurysm bursting and followed by extravasation of blood into the perivascular space, whereas among complications of a ruptured intracranial aneurysm there are enumerated: subarachnoid hemorrhage, recurrent hemorrhage, cerebral

vasospasm, cerebral ischemia, hydrocephalus and extracranial complications [14]. The frequency of hemorrhage from the intracranial aneurysm is estimated at over 90% of which subarachnoid hemorrhage is identified most often [5]. The not ruptured aneurysm of cerebral artery causes severe, throbbing headaches, aneurysm causes weakness or paralysis of certain muscle groups, sensory or balance disturbances, pain in eyeballs, blurred vision or partial blindness; sometimes anisocoria is observed [15]. Our research proved that headache had occurred as an cerebral aneurysm symptom in 15;78.7% of the tested patients. It occurred in12 women (87.7%) and 3 men (60.0%). Headache occurred in 6 patients (75.0%) with the anterior communicating artery aneurysm, 5 patients (83.3%) with the aneurysm of the left internal carotid artery, 4 patients (80.0%) with the aneurysm of the right internal carotid artery and 2 patients (20.0%) with the anterior communicating artery aneurysm. Whereas fainting as a symptom of the cerebral aneurysm occurred very rarely, only in 3 patients (15.8%).

Aneurysms are identified on the basis of symptoms resulting from pressure on adjacent structures or by accident during neuroimaging /TK, MRI/ [11,16]. Diagnostics also includes the neurological examination, angiography of cerebral arteries as well as cerebrospinal fluid tests [1,11]. The first examination carried out in patients with hemorrhage from the aneurysm is the computed tomography. In 93.6% of the patients hemorrhage was followed by the computed tomography examination of the head [11].

The computer tomography was the most often performed examination in the cerebral aneurysm diagnostics. It was carried out on 3 patients (20.0%) with the aneurysm on the right internal carotid artery, 6 (40.0%) and 6 (40.0%) patients with the aneurysm on the right internal carotid artery or in another location. Whereas angiography for the diagnostics purpose was carried out in the case of one person with the cerebral aneurysm.

Surgical treatment of not ruptured aneurysms is still controversial [5].The decision regarding the operation should be made based of the analysis of age (at the early age the risk of hemorrhage is higher), general condition of the patient, location of the aneurysm and operational availability, the size of the aneurysm as well as the patient's consent after having been presented all arguments for and against the operation [6,12]. At the Department and the Neurosurgery Clinic in Poznań in the case of patients where embolizaton was applied (50.05%) the larger group consisted of patients aged 41–50, whereas in the case of surgical treatment by means of the traditional method patients aged over 60 accounted for 35.3% of the patients [10]. In Dopierała's research the patients' age varied from 20 to73 years, age median (Me) — 53 years. In the group of women examined the age varied from 20 to 68 years, Me — 52 years; in the group of men — age 31–73 years, Me — 53 years. The largest group consisted of the examined patients aged 41–50 lat and over 60 years [13]. Our research proved that the oldest were patients with the aneurysm of the left internal carotid artery (58.17±8.28 years), and the youngest with the aneurysm of the right internal carotid artery (48.00±6.519 years), whereas the patients with the aneurysm on the anterior communicating artery or in another location were aged 53.11±8.92 years.

A lot of studies confirm that in the treatment of ruptured intracranial aneurysms, the best and most effective results are obtained after the application of surgical treatment involving the exclusion of the aneurysm from the circulation. Access to the pathology is obtained by craniotomy [5,17]. However, more frequent and more successful methods of endovascular treatment of arterial vascular pathology of the brain are used. The method of endovascular treatment of cerebral aneurysms can be applied in the case of at least 80% of patients with such pathology. Currently two methods of treatment are being applied: classical (clipping) and coiling [18]. In 2007 in the examined group there dominated surgeries carried out by means of the classical method — 34 patients, 10 patients were treated by embolization. The endovascular embolization of aneurysms with the use of detachable platinum coils almost completely replaced the traditional methods of microsurgery. In majority of cases regarding patients (95.6%) treated in the Department and Clinic of Neurosurgery and Neurotraumatology in the period 2004–2006 with the endovascular embolization method due to subarachnoid haemorrhage caused by the rupture of the aneurysm, the operations were carried out from femoral access. In the case of three patients the intervention was performed by reaching the common carotid artery, after its prior surgical dissection [10]. In Dopierała's research regarding patients with cerebral aneurysm in 77% of cases the traditional method was applied, and in 23% the method of aneurysm embolization with platinum coils was used [13]. Our research proved that most frequently applied surgical intervention in the treatment of not ruptured cerebral aneurysm was embolization (14;70.0%). It was carried out in 5 men (64.3%) and 9 women (83%) compared to 4 (20.0%) of craniotomy combined with clipping (0;0.0% v s 4;28.6%) and 2 (10.0%) of craniotomy (1;16.7% v s 2;7.1%).

In Andrzejewska's research, at the acceptance all patients were qualified according to GCS (Glasgow Coma Scale). All patients were conscious, 74.2% had the complete consciousness sustained and 25.8% showed various forms of disorientation. The patients in whom embolization was applied, obtained an average of twice the value with the use of GCS [19]. In our research all patients were assessed by the GCS Scale and were conscious.

The patients who were to undergo the embolization surgery obtained on average 14.85±0.555 points, and the craniotomy 15.00±0.000 point (NS).

Debrun claims that the technique of endovascular treatment with coils is safe and achieves satisfactory clinical results if the patient is qualified to this method with the aneurysm of appropriate shape and when the aneurysm sac ratio is smaller than 2 [20]. The average number of coils introduced into the aneurysm with patients with the aneurysm of the right internal carotid artery was 4.50±1.915, with the aneurysm of the left internal carotid artery was 5.20±2.387, with the aneurysm of the anterior communicating artery or another 6.20±0.447 (NS).

The functional capacity of the patient's on the day of discharging from hospital is considerably affected by clinical manifestation of the aneurysm and patient's condition before the surgery as well as by the type of surgical intervention applied [13,15]. The results of surgical treatment are affected by the following factors: location of the aneurysm, size of the aneurysm, presence of additional aneurysms, not ruptured aneurysm — perioperative mortality of not ruptured aneurysms is 2%, whereas it significantly increases after the treatment of bleeding aneurysms, age over 60 years and aneurysms identified in the 8th–9th decade of life, sex — clinical condition before the surgery, the operation manner, time of the surgery [8,21].

In our study the average number of points according to Glasgow Scale obtained after the surgery with patients with aneurysm on the right internal carotid artery was 15.00±0.000, with aneurysm on the left internal carotid 15.00±0.000, with the aneurysm located on the anterior communicating artery or another 14.75±0.707 (NS).

The period of the patient's stay after embolization according to the research carried out by Valavanis and partners amounts for 4–6 days [22]. Whereas the average period of hospitalization regarding the examined patients was significantly longer with the patients who had undergone the craniotomy surgery (10.00±2.160 days) than in the case of embolization (5.43±1.828 days) (p=0.006).

Conclusions

1. Not ruptured cerebral aneurysms occurred more often in women with anterior communicating artery aneurysm, and the computer tomography was the diagnosing examination which was performed most often.
2. Both hypertension and smoking as the risk factors for aneurysm appeared most often in patients with the aneurysm on the anterior artery.
3. Headache was the most common symptom of aneurysm with women, patients with hypertension and with the internal carotid artery aneurysm. Whereas in the case of men it was fainting which appeared most often.
4. Embolization was the type of surgical intervention to have been applied most often, particularly in the case of patients with the internal carotid artery aneurysym, hospitalization proceeded in the Schedule mode and its duration was significantly shorter.
5. Heart rate and systolic blood pressure were significantly higher in the case of patients with anterior communicating artery aneurysm and hypertension where hypertension both systolic as well as diastolic was higher with older patients suffering from a headache. In contrast, the value of hemoglobin and hematocrit before the surgery was significantly higher with those who had ungergone embolization as well as with older patients.
6. After the surgery, patients with hypertension had higher heart rate, systolic blood pressure whereas tobacco smokers higher heart rate, blood pressure, and a shorter duration of hospitalization. Those suffering from a headaches an aneurysm symptom were hospitalized longer and had higher heart rate after the surgery.

Implications for Nursing Practice

Efficient education of patients and their families must include a thorough knowledge of the symptoms, complications and treatments for cerebral aneurysms for the purpose of exercising the proper care and observation, both professional as well as non-professional. The knowledge of prevention is also important — healthy lifestyle, physical activity, eating habits, in order to avoid the occurrence of subarachnoid hemorrhage.

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