ENDOVASCULAR MANAGEMENT OF COMPLEX INTRACRANIAL ANEURYSMS

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Abstract

Background: Massive subarachnoid hemorrhage (SAH) or thromboembolic events caused by the dislodgement of intraluminal thrombus inside the aneurysms fundus may make giant intracranial aneurysms clinically obvious. These conditions manifest as increasing localized neurologic impairment. Endovascular treatment of these aneurysms was the focus of this study, which aimed to assess its safety and effectiveness.

Methods: This prospective research was conducted on 16 patients diagnosed with large and giant intracranial aneurysms, from 2019 to 2022 underwent 20 endovascular therapeutic procedures.

Results: 16 patients (9 females and 7 males) with large and giant intracranial aneurysms. Six aneurysms were ruptured (37.5%) and ten aneurysms were unruptured (62.5%). Age ranged from 2 years old to 60 years old**.** As regard clinical outcome 19 procedures with favorable (95%) and unfavorable in one procedure (5%). Regarding grades of aneurysm occlusion in the final control angiography, it was grade 0 in 5(25.0%) patients, grade 1in 11(55.0%) patients, grade 2 in 2(10.0%) patients, grade 3 in 2(10.0%). There is a significant difference was found between aneurysm morphology and the grade of aneurysm occlusion (p= 0.041). The aneurysm regrowth in relation to the grade of aneurysm occlusion is nearly significant and this indicated that if a big number of cases was studied it may become significant (P=0.090).

Conclusions: Endovascular management of large and giant intracranial aneurysms is feasible with high efficacy and more safety profile.

Keywords: Endovascular, Management, Complex Intracranial Aneurysms, Internal Carotid Artery, Parent Arterial Occlusion**.**

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Introduction:

Intracranial aneurysms are categorized by size as small (up to 15mm), large (15-25mm), and gigantic (more than 25mm) according to the first ISUIA study. The second phase of the International Study of Unruptured Intracranial Aneurysms (ISUIA) introduced a revised classification system that categorizes aneurysm diameters into small (<7 mm), medium (7 mm–12 mm), big (12 mm–25 mm), and giant (>25 mm) depending on rupture risk. UCAS categorized aneurysms by size as small (<5 mm), medium (5 mm–10 mm), big (10 mm–25 mm), and gigantic (>25 mm)(1-4). Huge aneurysms may form in the posterior circulation (basilar artery and parent arterial occlusion (PCA) aneurysm) or the anterior circulation (cavernous, supraclinoid portion of the internal carotid artery; anterior and middle cerebral arteries), but they are rare[5].

Large intracranial aneurysms (>2.5 cm) may cause neurological problems due to pressure, bleeding in the space around the brain, or blood clots breaking loose from the aneurysm. Endovascular therapy may help decrease the likelihood of rupture and thromboembolism, as well as alleviate symptoms caused by pressure from the mass[6].

Morbidity and mortality rates of surgery exceed the risk of rapture in patients with aneurysms less than 10 mm in diameter, even 7.5 tears after diagnosis [7]. Endovascular treatment for intracranial aneurysms has developed over the past decades. It is suggested to have lower procedural morbidity and mortality than conventional surgical procedures. [8].

This research is to evaluate the efficacy and safety of endovascular therapy for large and giant aneurysms.

Materials and Methods:

Prospective research was conducted on 16 patients with large cerebral aneurysms at the Neurosurgery Department from 2019 to 2022. These patients had a total of 20 endovascular therapy treatments. The research was done with approval from the Ethical Committee of Al Azahar University Hospitals in Cairo, Egypt.

Preoperative evaluation:

The patients or their family were informed about the operation, potential problems, radiation dangers, contrast adverse reactions, alternative diagnostic and therapy alternatives, and their signed agreement was obtained. A thorough evaluation was completed, including obtaining an extensive medical history, conducting a physical examination, and performing essential laboratory tests like Complete Blood Count (CBC), Prothrombin Time (PT)/Activated Partial Thromboplastin Time (aPTT) and INR, renal and liver function tests, Arterial Blood Gases (ABG), and serum chemistries (electrolytes and osmolarity).Radiological assessments included computed tomography (CT) for suspected cases of subarachnoid hemorrhage (SAH), magnetic resonance imaging (MRI) for evaluating large and giant aneurysms presenting with typical SAH symptoms but no visible blood in the CT scan, or for early complication detection during follow-up, and angiography for all patients with ruptured aneurysms before undergoing therapeutic procedures with specialized software programs.

Premedication: Administered under general anesthesia with endotracheal intubation. All patients received a loading dose of Epanutin (phenytoin) at a rate of 20 mg/kg intravenously. A 5000 unit intravenous bolus was given when the non-detachable balloon or the first embolic device was introduced. The systemic heparinization was sustained with the continuous infusion of 1000 units of heparin per hour. After systemic heparinization, the arterial sheath was not withdrawn at completion of the surgery. Administer intravenous protamine sulfate (50 mg, one ampoule) to reverse heparin in instances of intraoperative aneurysm rupture. Clopidogrel (PlavixTM) was administered orally for 7 days prior to the intended stent procedure.

Endovascular treatment

Approach and arterial sheath, both ionic and non-ionic iodine-based contrast agents, endovascular devices, diagnostic catheters, guiding catheters, guiding wires, microcatheters, microguiding wires, synchro, X-pedion and steel, coils, non-detachable balloons and stents.

Interventions were done as soon as possible after presentation and diagnosis of ruptured and unruptuered aneurysms irrespective of the time scale of expected risk of vasospasm for patient with SAH. A formal diagnostic cerebral angiography was performed first utilizing a diagnostic catheter. The guiding catheter was advanced to the skull base, specifically the commencement of the petrous segment.

The guiding catheter is connected to a continuous flush system by a Y-connector. When faced with vasospasm during catheter navigation, raising the flow rate of the flush solution containing Nimotop and allowing a little period for it to work was often successful in alleviating the vasospasm. 3D reconstruction angiography allows for easy selection of the working angle from the 3D image. Steam molding of the catheter tip was done before inserting the microcatheter in every case. The catheter tip usually has a form defined by two obtuse angles. To compensate for the decrease in curves resulting from the removal of the shaping mandrel, the form was often overdone to get the desired shape. Later, the microcatheter was implanted with the assistance of a wire. The microcatheter was navigated via the cerebral arteries to reach the aneurysm. Heparinization was started systemically when the first coil was inserted.

Initially, 5000 units were given, then an extra 1000 units were delivered every hour. Coils were put into the aneurysm with or without road mapping, depending on the scenario. Coiling was performed until the aneurysm was fully occluded on the angiography or there was a significant risk of the coil mass causing obstruction in the main artery or a neighboring normal branch.

The balloon was inflated in the appropriate position across the aneurysm neck. Diluted contrast was used for balloon inflation. After securing the aneurysm neck, coils were deployed in the same manner as in standard coiling. With the Neuroform stent, the stent was deployed first then the aneurysm was subsequently catheterized with a microcatheter through the stent fenestrations. Coil embolization was then safely performed. In the case with the Solitaire stent, the aneurysm was catheterized first, opening the stent over the microcatheter was done (jailing), then coiling was performed. A pipeline stent was used in one case with cavernous segment aneurysm. Surpass stent was used in one case with regrowth cavernous segment aneurysm.

When preserving the parent artery during arterial system reconstruction was deemed impractical or too risky, the aneurysm and its parent artery were occluded using a deconstructive approach. A tolerance test for occlusion was conducted before the therapeutic procedure.

Postoperative care

Following the anesthetic recovery, the patient was sent to the neurosurgical Intensive Care Unit for overnight monitoring. The patient's hydration was maintained, and renal function was assessed post-procedure. SAH treatment and care were maintained for a duration of 3 weeks. Patients with intraoperative aneurysm perforation received same therapy. Oral administration of 150 mg of acetyl salicylic acid was started on the first day following surgery for all patients who underwent coiling and stenting. Acetyl salicylic acid was administered for a duration of one year. When a stent was inserted, the patient was additionally prescribed 75 mg of clopidogrel to be taken orally for a duration of 3 months.

Assessment of technical feasibility

If at least one coil or stent could be successfully placed, the therapy was deemed technically possible; otherwise, it was classified as a technical failure.

Clinical outcome assessment: The Glasgow Outcome Scale (GOS) score was documented at discharge and throughout the follow-up. surgery-related morbidity is recorded when a new neurological deficiency persists for over 7 days and may be directly linked to the surgery. If a death was determined to be not caused by the surgery, it was classified as an unconnected death in the patient's clinical status (one instance).

Radiological outcome assessment according to mayer et al [9], Occlusion degree was noted in the final control angiography and in the angiographic follow-up.

Statistical analysis

Statistical analysis was conducted using SPSS v26, a software produced by IBM Inc. headquartered in Chicago, IL, USA. An ANOVA (F) test was used to compare the three groups, followed by Tukey's post hoc test. Quantitative data were presented as mean and standard deviation (SD). The qualitative variables were shown with their frequency and percentage, and the Chi-square test was used for analysis. Statistical significance was established based on a two-tailed P value below 0.05.

Results:

In the present study, a consecutive series of 20 endovascular therapeutic procedures were performed for 16 patients (9 females and 7 males) with large and giant intracranial aneurysms. Six aneurysms were ruptured (37.5%) and ten aneurysms were unruptured (62.5%). Age ranged from 2 years old to 60 years old (mean± SD 38.75±18.29).

all procedures were completed. Flow diverter Stenting was attempted in 2 cases. It was necessary to deploy the stents across the aneurysm's neck in both cases. However, an iatrogenic carotid cavernous fistula formed in one of the two cases as the stent was being deployed. This complication was treated at the same appointment. Five patients (or 25.0% of the total) had a grade 0 aneurysm occlusion, eleven patients (or 55.0% of the total) had a grade 1, two patients (or 10.0% of the total) had a grade 2, two patients (or 10.0% of the total) had a grade 3, and no patients (or grade 4) had a grade 4 occlusion found. **Table 1**

Clinical outcomes did not vary according on age, sex, or the presence of ruptured or unruptured aneurysms. Co-morbidity's presence was linked to a worse clinical outcome; however, the association was not statistically significant (P = 0.554). Angiographic follow-up was conducted for treated aneurysms. Upon follow-up, 4 aneurysms (28.57%) were classified as grade 0, 8 (57.14%) as grade 1, 1 (7.14%) as grade 2, and 1 (7.14%) as grade 3. **Table 2**

The type of the endovascular procedure was not associated with statistically significant difference in the clinical outcome. Procedures which were free from intraoperative complications and grade of aneurysm occlusion had significantly better clinical outcome (P=0.050, 0.024 respectively). **Table 3**

There was no statistically significant difference between grades of aneurysm occlusion in relation to sex, medical co-morbidity, ruptured aneurysm, aneurysm's location, size, etiology and neck, type of the endovascular procedure and occurrence of intraoperative complications. There is a statistically significant difference was found between aneurysm morphology and the grade of aneurysm occlusion (p= 0.041). **Table 4**

There was no statistically significant difference detected between the incidence of regrowth and any patients, aneurysm or procedural factors. The aneurysm regrowth in relation to the grade of aneurysm occlusion is nearly statistically significant and this indicated that if a big number of cases was be studied it may become statistically significant(P=0.090). **Table 5**

There was no statistically significant difference detected in the incidence of complications and the type of the procedure (P=0.158). Cases with intraoperative thrombosis were treated intraoperatively by mechanical and pharmacological thrombolysis. Iatrogenic CCF occurred in one case. Patient had postoperative third nerve palsy (GOS 4). Third nerve palsy improved within three weeks after operation. **Table 6**

Table 1: Technical success, technical failure of the therapeutic procedures and grades of occlusion in the final control of the treated aneurysms

		N=20
Technical success		20 (100%)
Reconstructive approaches	**Standard coiling**	14(70%)
	Balloon assisted coiling	1(5%)
	Stent assisted coiling	2(10%)
	Flow-diverter stenting	2(10%)
Deconstructive approaches	**Hunterian coiling**	1(5%)
	Technical failure	0(0%)
Grade of occlusion	**Grade 0**	5(25.0%)
	Grade 1	11(55.0%)
	Grade 2	2(10.0%)
	Grade 3	2(10.0%)
	Grade 4	0(0.0%)

Data are presented as frequency (%).

Table 2: Relation of the clinical outcome to demographic data, medical co-morbidity, HTN, DM, the rupture of the aneurysm, aneurysm's location, size, morphology and neck

		GOS		P
		Unfavorable	**Favorable**	
Age	**<40**	0(0.0%)	10(50.0%)	1.000
	>40	1(5.0%)	9(45.0%)	
Sex	**Female**	0(0.0%)	12(60.0%)	0.834
	Male	1(5.0%)	7(35.0%)	
Medical co-morbidity	**HTN**	1(5.0%)	4(20.0%)	0.554
	DM	1(5.0%)	4(20.0%)	0.171
Rupture of the aneurysm		1(5.0%)	5(25.0%)	0.625
Aneurysm's location	**P.com**	0(0.0%)	6(30.0%)	0.310
	A.com	1(5.0%)	2(10.0%)	
	Ophth	0(0.0%)	2(10.0%)	
	Cavernous I.C.A (C4)	0(0.0%)	7(35.0%)	
	MCA	0(0.0%)	1(50.0%)	
	Basilar trunke	0(0.0%)	1(50.0%)	
Aneurysms size	**large**	1(5.0%)	14(70.0%)	0.554
	Giant	0(0.0%)	5(25.0%)	
Aneurysms morphology	**Nonsaccular**	0(0.0%)	5(25.0%)	0.544
	Saccular	1(5.0%)	14(70.0%)	
Aneurysms etiology	**Idiopathic (Degenerative)**	1(5.0%)	17(85.0%)	0.943
	Infective	0(0.0%)	1(5.0%)	
	Traumatic	0(0.0%)	1(5.0%)	
Aneurysm neck	**Narrow**	1(5.0%)	14(70.0%)	0.554
	Wide	0(0.0%)	5(25.0%)	

Data are presented as frequency (%). HTN: hypertension, DM: diabetes mellitus, ICA: internal carotid artery, MCA: middle cerebral artery, GOS: Glasgow Outcome Score.

Table 3: Relation of the clinical outcome to the type of the endovascular procedure, occurrence of intraoperative complications and grade of initial angiographic occlusion

		GOS		P
		Unfavorable	**Favorable**	
Type of the endovascular procedure	**Stander Coiling**	1(5.0%)	13(65.0%)	0.978
	Balloon-assisted Coiling	0(0.0%)	1(5.0%)	
	Stent-assisted Coiling	0(0.0%)	2(10.0%)	
	Flow diverter Stent	0(0.0%)	2(10.0%)	
	PAO	0(0.0%)	1(50.0%)	
Intraoperative complications	**No complications**	0(0.0%)	16(80.0%)	**0.050***
	Thrombosis	1(50.0%)	2(10.0%)	
	Iatrogenic CCF	0(0.0%)	1(50.0%)	
	Technical failure	0(0.0%)	0(0.0%)	
Grade of angiographic occlusion	**Grade 0**	0(0.0%)	5(25.0%)	**0.024***
	Grade 1	0(0.0%)	11(55.0%)	
	Grade 2	1(5.0%)	1(5.0%)	
	Grade 3	0(0.0%)	2(10.0%)	
	Grade 4	0(0.0%)	0(0.0%)	

Data are presented as frequency (%). *Significant p value <0.05, PAO: Parent arterial occlusion, CCF: Congestive cardiac failure, GOS: Glasgow Outcome Score.

Table 4: Relation between the sex, presence of medical co-morbidity, operating on ruptured aneurysm, aneurysm's location, size, morphology, etiology and neck, type of the endovascular procedure and occurrence of intraoperative complications and the grade of aneurysm occlusion

		Grade of occlusion					P
		Grade 0	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	
Sex	**Female**	4(20.0%)	7(35.0%)	0(0.0%)	1(5.0%)	0(0.0%)	0.264
	Male	1(5.0%)	4(20.0%)	2(10.0%)	1(5.0%)	0(0.0%)	
Medical co-morbidity		3(15.0%)	1(5.0%)	1(5.0%)	0(0.0%)	0(0.0%)	0.108
Ruptured aneurysm		1(5.0%)	3(15.0%)	1(5.0%)	1(5.0%)	0(0.0%)	0.792
Location	**Pcom**	2(10.0%)	4(20.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0.417
	Acom	0(0.0%)	2(10.0%)	1(5.0%)	0(0.0%)	0(0.0%)	
	Ophth	1(5.0%)	1(5.0%)	0(0.0%)	0(0.0%)	0(0.0%)	
	Cavernous ICA(C4)	2(10.0%)	3(15.0%)	1(5.0%)	1(5.0%)	0(0.0%)	
	MCA	0(0.0%)	0(0.0%)	0(0.0%)	1(5.0%)	0(0.0%)	
	Basilar trunk	0(0.0%)	1(5.0%)	0(0.0%)	0(0.0%)	0(0.0%)	
Size	**Large**	4(20.0%)	7(35.0%)	2(10.0%)	2(10.0%)	0(0.0%)	0.540
	Giant	1(5.0%)	4(20.0%)	0(0.0%)	0(0.0%)	0(0.0%)	
Morphology	**Nonsaccular**	3(15.0%)	0(0.0%)	1(5.0%)	1(5.0%)	0(0.0%)	**0.041***
	Saccular	2(10.0%)	11(55.0%)	1(5.0%)	1(5.0%)	0(0.0%)	
Etiology	**Degenerative (Idiopathic)**	4(20.0%)	10(50.0%)	2(10.0%)	2(10.0%)	0(0.0%)	0.688
	Infective	1(5.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	
	Traumatic	0(0.0%)	1(5.0%)	0(0.0%)	0(0.0%)	0(0.0%)	
Neck	**Narrow**	3(15.0%)	10(50.0%)	1(5.0%)	1(5.0%)	0(0.0%)	0.332
	Wide	2(10.0%)	1(5.0%)	1(5.0%)	1(5.0%)	0(0.0%)	
Type of the endovascular procedure	**Stander Coiling**	2(10.0%)	10(50.0%)	1(5.0%)	1(5.0%)	0(0.0%)	0.080
	Balloon assisted	0(0.0%)	1(5.0%)	0(0.0%)	0(0.0%)	0(0.0%)	
	Stent-assisted	0(0.0%)	0(0.0%)	1(5.0%)	1(5.0%)	0(0.0%)	
	Flow diverter Stent	2(10.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	
	PAO	1(5.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	
Intraoperative Complications	**Thrombosis**	0(0.0%)	1(5.0%)	1(5.0%)	1(5.0%)	0(0.0%)	0.247
	Iatrogenic CCF	1(5.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	

Data are presented as frequency (%). *Significant p value <0.05, PAO: Parent arterial occlusion, CCF: carotid cavernous fistula.

Table 5: Relation between age, sex, type of the endovascular and flow diverter procedure, neck, size, morphology, etiology, location and grade of aneurysm, medical co morbidities and HTN and the aneurysm regrowth

		Regrowth		P
		Negative	**Positive**	
Age	**<40**	3(21.43%)	5(35.71%)	0.589
	>40	4(28.57%)	2(14.29%)	
Sex	**Female**	6(42.86%)	2(14.29%)	0.105
	Male	1(7.14%)	5(35.71%)	
Type of the endovascular procedure	**Coiling**	3(21.43%)	5(35.71%)	0.165
	Balloon-assisted	1(7.14%)	0(0.0%)	
	Stent-assisted	0(0.0%)	2(14.29%)	
	Flow diverter Stent	2(14.29%)	0(0.0%)	
	PAO	1(7.14%)	0(0.0%)	
Flow diverter procedure	**Flow**	2(14.29%)	0(0.0%)	0.445
	Non-Flow	5(35.71%)	7(50.0%)	
Aneurysm neck	**Narrow**	5(35.71%)	5(35.71%)	0.554
	Wide	2(14.29%)	2(14.29%)	
Aneurysm size	**Large**	5(35.71%)	5(35.71%)	0.554
	Giant	2(14.29%)	2(14.29%)	
Aneurysm morphology	**Non saccular**	2(14.29%)	3(21.43%)	0.687
	Saccular	4(28.57%)	5(35.71%)	
Aneurysm etiology	**Degenerative (Idiopathic)**	5(35.71%)	7(50.0%)	
	Infective	1(7.14%)	0(0.0%)	0.311
	Traumatic	1(7.14%)	0(0.0%)	
Medical co morbidities		3(21.43%)	0(0.0%)	0.193
HTN		3(21.43%)	0(0.0%)	0.193
Aneurysm location	**P.com**	2(14.29%)	2(14.29%)	0.369
	A.com	1(7.14%)	0(0.0%)	
	Ophth	1(7.14%)	0(0.0%)	
	Cavernous I.C.A (C4)	2(14.29%)	5(35.71%)	
	MCA	0(0.0%)	0(0.0%)	
	Basilar trunke	1(7.14%)	0(0.0%)	
Grade of occlusion	**Grade 0**	4(28.57%)	0(0.0%)	0.090
	Grade 1	3(21.43%)	5(35.71%)	
	Grade 2	0(0.0%)	1(7.14%)	
	Grade 3	0(0.0%)	1(7.14%)	
	Grade 4	0(0.0%)	0(0.0%)	

Data are presented as frequency (%). HTN: hypertension, DM: diabetes mellitus, ICA: internal carotid artery, MCA: middle cerebral artery. PAO: Parent arterial occlusion.

Table 6: Relation between and the type of the endovascular procedures

	Procedures					
	Stander coiling	**Balloon assisted coiling**	**stent-assisted coiling**	**Flow diverter Stent**	**PAO**	**P**
No Complications	12(60.0%)	1(5.0%)	1(5.0%)	1(5.0%)	1(5.0%)	0.158
Thrombosis	2(10.0%)	0(0.0%)	1(5.0%)	0(0.0%)	0(0.0%)	
Iatrogenic CCF	0(0.0%)	0(0.0%)	0(0.0%)	1(5.0%)	0(0.0%)	

Data are presented as frequency (%). PAO: Parent arterial occlusion, CCF: carotid cavernous fistula.

Discussion

Morbidity and mortality rates of surgery exceed the risk of rapture in patients with aneurysms less than 10 mm in diameter, even 7.5 tears after diagnosis [7] especially for large and giant aneurysms were neck exposure and parent vessels dissection during surgery more challenging, so endovascular treatment was introduced as an alternative treatment with supposed low complication rate.

In this investigation, the occurrence of co-morbidity was not substantially linked to a worse clinical result. The presence of hypertension and diabetes mellitus did not show statistical significance. Van Rooij and Sluzewsk(10) reported that out of 1344 aneurysms treated using endovascular methods, 232 (17.3%) were classified as huge or monstrous in size. 150 aneurysms (11.2%) were categorized as big, while 82 (6.1%) were classed as enormous. Large aneurysms account for 75% of the study aneurysms, with 15 cases, whereas gigantic aneurysms represent 25% of the research aneurysms, with 5 cases. Out of the big aneurysms, 4 are entirely occluded (26.66%), whereas out of the Giant aneurysms, 1 is completely occluded (20%). The current investigation found no statistically significant relationship between aneurysm size and aneurysm occlusion (p = 0.540). The research found a statistically significant association between aneurysm morphology and the degree of aneurysm closure (p=0.041). Standhardt et al. [11] observed a substantial correlation between neck size and occlusion rate. In tiny neck aneurysms, the occlusion rate was much higher with 77.1% full closure, 18.1% neck remnant, and 4.8% incomplete closure. In broad neck aneurysms, the occlusion rate was 35.8% complete closure, 51.6% neck remnant, and 12.6% partial closure.

In the present study, the relation between aneurysm neck, size and etiology with clinical outcome is statistically insignificant. According to Van Rooij and Sluzewsk [10] The carotid artery, especially in the cavernous sinus, is the most common location for large and enormous aneurysms in the front section of the brain's blood circulation. The basilar tip is the predominant location in the posterior circulation. Out of 16 aneurysms investigated, 15 were situated in the anterior circulation, accounting for 95% of the patients. 20% of instances occur in the posterior circulation. 20% are situated in the cavernous I.C.A (C4).

Seven large, cavernous carotid aneurysms were managed using various endovascular techniques: 3 with standard aneurysm coiling, 2 with stent-assisted coiling, 1 with a flow diverter stent, and 1 with Hunterian coiling. 95% of the aneurysms had reconstructive operations. Advancements in endovascular devices and procedures, including as balloon remodeling, stent-assisted coiling, and flow diverter stents, have made it possible to treat numerous aneurysms using a reconstructive approach. In the present study, 1(5%) of the aneurysms were treated with a deconstructive procedure. It was non-saccular aneurysm with infective etiology.

In this investigation, endovascular therapy proved technically viable for all big and gigantic aneurysms. The findings are being compared to other endovascular series that have been publishedS[12-15], was slightly higher, in which the technical feasibility rates in other published endovascular series range from 84% to 97%.

In this study the clinical outcome of 20 endovascular procedures for large and giant intracranial aneurysms, with no procedure with technical failure, was favorable in 95% of cases and unfavorable in 5% of cases. By favorable outcome we mean GOS four or five, and unfavorable outcome means GOS less than 4. At 3 months, 95% of cases had favorable outcome and 1% died. This is higher than what was reported in published literature. In the ISAT study [13] 76.5% of the patients in the endovascular group achieved independence (GOS 4 and 5) after one year.

The clinical result in this research was not significantly different based on the kind of endovascular treatment. Sturiale et al. found that the clinical result of endovascular therapy for cerebral aneurysms is not significantly related to the kind of endovascular operation [16].

In this study the better initial clinical outcome was associated with statistically significant in relation to the grade of aneurysm occlusion (P=0.024). According to Van Rooij and Sluzewsk [10] Several variables, such as the incidence of procedural problems, determine the clinical outcome of endovascular treatment of big and enormous cerebral aneurysms.

The clinical results were much better for the operations in this research that did not have any intraoperative problems.

The current research found that 25% of patients (n=5) had first full aneurysm closure. There has been a little decrease from earlier reports. At first, 32.9% of saccular aneurysms were successfully occluded[17].

The research identified a statistically significant difference between aneurysm morphology and the degree of aneurysm occlusion. According to Meyers et al. [9] Both the kind of endovascular procedure used and the location of the aneurysm's neck have a significant impact on the final degree of closure. Regarding the aneurysm's neck, this study found no statistically significant difference in the aneurysm closure grades.

No statistically significant difference was observed in grades of aneurysm occlusion based on the kind of endovascular surgery. The p-value of 0.080 for aneurysm occlusion in connection to the kind of endovascular technique is approaching statistical significance, suggesting that with a larger sample size, the results may become meaningful. It may reach statistical significance.

Otherwise, there is no statistically significant difference was found between the grade of aneurysm occlusion in relation to other aneurismal factors such as (size, etiology, and location).

An aneurysm might enlarge or regenerate following coil embolization. This may happen even in aneurysms that seem fully blocked following the first therapy. Additional embolization may be necessary to inhibit expansion and possibly subarachnoid hemorrhage[18].

Subsequent imaging is necessary to detect any untreated aneurysms before the onset of subarachnoid hemorrhage or other symptoms. After the first coil embolization, a varying proportion of aneurysms needed further treatment. If coil embolization is not feasible to complete the therapy, alternative endovascular surgical methods may be necessary[19]. According to Van Rooij and Sluzewsk [10] Most coiled big and gigantic aneurysms tend to reopen, especially if the reopening is limited to the neck. In such cases, the patient should be scheduled for a follow-up in 6 months and annually afterward. If reopening leads to incomplete aneurysm filling, more coiling should be performed as needed, perhaps with the use of a balloon or stent.

In this study angiographic follow up was done for 14 aneurysms (70%). Catheter angiography was done for 11 aneurysms (55%). MRA (with complementary MRI) was done for two aneurysms (10%), one after hunterian coiling and one after flow diverter stent as the patient becomes pregnant immediately. CT angiography was done for one aneurysm (5%) as the patient refuse Catheter angiography.

In this study the incidence of regrowth is 7(50%) and this incidence goes in accordance with published endovascular series or slightly less. In this study there is no statistically significant difference was detected between the incidence of regrowth and any patients, aneurysm or procedural factors but the (P=0.090) of the aneurysm regrowth in relation to the grade of aneurysm occlusion is nearly statistically significant and this indicated that if a big number of cases was studied it may become statistically significant.

Intraoperative rupture and thromboembolic events are the main risks of endovascular treatment for brain aneurysms.[20].

The research found that 25% (n=5) of aneurysms were completely occluded initially. This is somewhat lower than the amount documented in earlier publications. Initial complete closure was accomplished in 32.9% of saccular aneurysms.

The investigation documented a complication risk of 20% associated with the operation. 5% of operations for ruptured aneurysms and 15% of procedures for unruptured aneurysms had complications. This analysis did not find any significant variation in the rate of complications associated to the treatment depending on the kind of endovascular technique. The study recorded intraoperative thrombosis in 3 instances (15%) and iatrogenic carotid cavernous fistula in 1 case (5%).

Procedural thromboembolic complication rates after endovascular treatment of cerebral aneurysms range from 2.7% to 17%.[21,22].

In the present study, intraoperative thrombosis happened in 3(15%), one ruptured (5%) aneurysm and two unruptured (10%) of the therapeutic procedures. Cases with intraoperative thrombosis were treated intraoperatively by mechanical and pharmacological thrombolysis. Intraoperative thrombolysis was achieved in all cases. Postoperatively, all cases were neurologically intact. This means that the outcome of intraoperative thrombosis was better.

Limitations of this study included that small sample size may necessitate further research with a larger sample size.

Conclusions:

Endovascular management of large and giant intracranial aneurysms is feasible with high efficacy and more safety profile.

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