

CLINICAL AND RADIOLOGICAL EVALUATION OF PATIENTS WITH SUBARACHNOID HAEMORRHAGE SUBJECTED TO DIGITAL SUBTRACTION ANGIOGRAPHY IN AL-HUSSEIN NEURO-INTERVENTION UNIT

By

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ABSTRACT

Background: Subarachnoid hemorrhage (SAH) refers to bleeding that occurs primarily within the subarachnoid space, in between cases of spontaneous SAH and rupture of an intracranial saccular aneurysm accounts for approximately 85%.

Objectives: The aim of this study was to assess clinical presentation, risk factors and the etiology of subarachnoid hemorrhage in a sample of Egyptian patients, and also assess the outcome of endovascular management and complications.

Patients and Methods: The study was carried out on patients with SAH who were subjected to endovascular neuro-intervention unit in AL-Husseini University Hospital, including patients with SAH retrospectively from 2006 to 2018, and the newly diagnosed patients during 2019.

Results: During the period from May 2006 to May 2019, 560 patients with SAH has been admitted. 136 patients (24.2%) were excluded from the study as they were critically ill. Their Hunt and Hess score were 4 to 5. Also, another 51 has been excluded due to missed files or discharge against medical advice. The remaining 373 patients. 145 patients were angiographically free, Patients with aneurysm were 228 patients, 77 patients died before therapeutic endovascular treatment as they delayed due to financial troubles, The remaining patients were 151, The most common type of aneurysm between those patients was anterior communicating aneurysm (27.8%), then MCA aneurysm (17.8%), posterior communicating artery aneurysm (13.9%), para-ophthalmic artery aneurysm (6.6 %), basilar artery aneurysm (5.9%), posterior inferior cerebellar artery aneurysm (6.4%), supraclinoid carotid artery aneurysm (3.1%), peri callosal artery aneurysm (3.3%), T carotid artery aneurysm (7.2%), superior cerebellar artery aneurysm (1.9%), inferior cerebellar artery aneurysm (2.6%) and multiple aneurysms (6.6%). The complications of endovascular treatment in studied patients occurred in 13 patients (3.4%) in the form of aneurysmal rupture, coil displacement, hydrocephalus and vessel rupture.

Conclusion: Cerebral catheter angiography is a safe, feasible and efficacious procedure. The new technique in the endovascular management of the cerebral aneurysm as balloon or stent assisted technique and flow diverter stent is greatly reducing the complication rate and making the outcome is very promising.

Keywords: Subarachnoid Hemorrhage, Digital Subtraction Angiography.

INTRODUCTION

Classical clinical presentation of SAH is characterized by a sudden and explosive headache never felt in the patient's clinical history. Disturbed consciousness occurs in almost half of the patients and focal neurological signs develop afterward in one-third of the cases (*Mac Grory et al., 2018*).

Primary causes of death were direct effect of the primary hemorrhage, aneurysm rebleeding, cerebral infarction from vasospasm, refractory cerebral edema leading to brain stem herniation, hydrocephalus, operative complications and medical complications, e.g., fatal arrhythmia, pulmonary embolism, or multisystem organ failure (*Jeon et al., 2013*).

The progress experienced in the management and treatment of patients suffering from SAH allowed a marked improvement in prognosis, achieving a reduction in the mortality rate and not increasing the number of patients remaining in a persistent vegetative state or developing severe disability (*Ayling et al., 2016*).

The primary goal of treatment was to exclude the aneurysm sac from the intracranial circulation while preserving the parent artery (*Wiebers et al., 2017*).

The aim of this study was to assess clinical presentation, risk factors and the etiology of subarachnoid hemorrhage in a sample of Egyptian patients, and also assess outcome after endovascular management and complications.

PATIENTS AND METHODS

The study was carried out on patients with SAH admitted in stroke units of Al-Hussein University Hospital and Bab Al-Shaeria University Hospital, retrospectively from 2006 to 2018 and the newly diagnosed patients during 2019 who were subjected to endovascular management at Al-Hussein Neuro-intervention.

A written consent had been taken from every patient or his caregiver before starting of endovascular treatment.

Inclusion criteria:

Patients were selected after confirmation of SAH clinically (patient presented with SAH) and radiologically by doing CT scan of the brain and **laboratory** as lumbar puncture in case of -ve CT scan. The included patients were at age between 18 -80 years old patients and their Hunt and Hess grade up to 3.

Exclusion criteria:

Patients with traumatic SAH, hemorrhagic blood disease, poor clinical Hunt - Hess grade (grade 4, 5), and contraindications to 4 vessels angiography as renal failure and allergy.

All the patients were subjected to full neurological history and examination. **Categorization** of patients was according to the severity using **Hunt-Hiss** grading scale. **Radiological investigation:** Non contrast CT brain to detect the site of SAH through Fisher grading scale, CT angiography for diagnosis of aneurysm. Digital subtraction angiography for confirmation of the presence of aneurysm or vascular malformation and determine the mode of treatment. **Laboratory**

investigation: CBC, PT, INR, renal function test and liver function test, hepatitis markers, CSF analysis for xanthochromia in case of negative CT brain. **Modality of treatment** was according to the etiology as coiling either simple or balloon remodeling and/or stent assisted coil technique or flow diverter

stent in case of Aneurysm and embolization in case of other vascular malformations.

The patient was assessed post procedural for any neurological deficit and after 24 hours as well as assessment of complications and death rate in SAH.

RESULTS

This study was designed to make a scope on patients with SAH who were subjected to endovascular treatment in our stroke unit. During the period from May 2006 to May 2019, we had 560 patients with SAH; their mean age of them was 42.7 ± 9.4 years.

We had 136 patients (24.2%) excluded from the study as they were critically ill and their Hunt and Hess score were 4 to 5, another 51 (9.1%). Missed patients have been excluded due to incomplete data of them and part of them was discharged against medical advice.

The remaining patients (373 patients) were subjected to endovascular diagnostic unit; 145 patients (38.8%) of them were angiographically free, and 228 patients (60.2%) had aneurysm; 77 patients of

them (33.7%) died during the period between admission and doing the endovascular management. Their causes of death were 31 patients (40.2%) had rebleeding, 23 patients (29.2%) had early vasospasm, 11 patients (14.2%) had pulmonary embolism, and 12 patients (15.5%) had cardiac arrhythmia.

The mean age in this study in included patient was 38 ± 9.4 , and 53% of them were males (**Table 1**). However, in patients with aneurysmal SAH, females were more common than males (**Table 2**).

As regard comorbidities and risk factors in the studied patients. The most common risk factor is hypertensive (44.1%) patients then diabetic patients.

Table (1): Description of age and sex in studied patients

Variables		Studied patients (N = 373)	
Age (years)	Mean±SD	38 ± 9.4	
	Min – Max	22 – 74	
Sex	Male	198	53.1%
	Female	175	46.9%
HTN	Non	208	55.8%
	Known	165	44.2%
DM	Non	290	77.8%
	Known	83	22.2%
Smoking	Non	315	84.5%
	Smoker	58	15.3%
History of infective endocarditic and rheumatic heart disease	No	365	97.8%
	Yes	8	2.2%
Family history of aneurysm	No	355	95.2%
	Yes	18	4.8%

Comparison between patients who were angiographically free versus the patients with aneurysm. The percentage of males were (51.6 %), females were (48.4%) The reverse occurred in the other group in which the female patients were 53 %, and males were 47%. The noncontract enhanced brain CT revealed in the angiographically free group that the

perimesencephalic cases were 70% and the non-peri mesencephalic cases were 30%, while in the other group the perimesencephalic cases were 10.1% and the non-peri mesencephalic cases were 89.9 %, the clinical assessment through the HUNT-HESS grading scale it revealed that the severity is the more in the patient with aneurysm (Table 2)

Table (2): Comparison between patients who are angiographically free versus with aneurysm (N=373)

Groups Variables	Patients who were angiographically free 145 (38.8%)		Patients with aneurysm 228 (61.2%)	
Male to female ratio	62.1% : 37.9%		47.4% : 52.6%	
CT hemorrhage	Perimesencephalic 70% 101 patients	Non peri mesencephalic 30% 44 patients	Perimesencephalic 10.1% 23 patients	Non peri mesencephalic 89.9% 205 patients
Hunt-Hess grading scale	1-2		2-3	

The most common neurological symptoms in the included patients was headache 48.6%, 0.4% patients presented by headache with ataxia, (10%) patients presented by headache and Disturbed conscious level (DCL), 6.6% patients presented by headache and 3rd nerve palsy, 4.3% patients presented by

headache and neck stiffness, 9.6% patients presented by fits, 3.6% patients presented by DCL and fits, 4.6% patients presented by DCL and left side weakness, 6.4% patients presented by DCL and meningeal irritation signs, and 5.9% patients presented by DCL and right side weakness (Table 3).

Table (3): Description of clinical presentation in studied patients

Clinical presentation	Patients (n=373)	Percent %
Headache	181	48.5%
Headache and ataxia	2	0.5%
Headache and DCL	37	9.9%
Headache and 3rd nerve palsy	24	6.4%
Headache neck stiffness	17	4.6%
Fits	35	9.4%
DCL and fits	13	3.5%
DCL and left side weakness	18	4.8%
DCL and Meningeal irritation signs	24	6.4%
DCL and Right-side weakness	22	5.9%

Anterior communicating artery aneurysm occurred in 26.7% of patients, MCA aneurysm in 18.4%, posterior communicating aneurysm in 13.2%, paraophthalmic artery aneurysm in 7%, basilar artery aneurysm in 7.9%, posterior inferior cerebellar artery aneurysm in 4.3%, supraclenoid carotid artery

aneurysm in 3%, peri callosal artery aneurysm in 3.5%, T carotid artery aneurysm patients in 7.9%, superior cerebellar artery aneurysm in 1.8%, inferior cerebellar artery aneurysms in 1.7%, and multiple aneurysms in 4.3% of patients (Table 4).

Table (4): Type of aneurysms according to site Total number = 228

Parameters Site of aneurysm	Died cases (N = 77)	percent (32.8 %)	Therapeutic Endovascular management (N=151)	Percent 66.2%
Anterior communicating aneurysm	19	24.7%	42	27.8%
Middle cerebral artery aneurysm	15	17.5%	27	17.9%
Posterior communicating artery aneurysm	9	11.7%	21	13.9%
Para-ophthalmic artery aneurysm	6	7.8%	10	6.6%
Basilar artery aneurysm	9	11.7%	9	6%
Posterior inferior cerebellar artery	5	6.5%	5	3.3%
Supraclenoid carotid artery aneurysm	3	3.9%	4	2.6%
Peri callossal artery aneurysm	3	3.9%	5	3.3%
T –carotid artery aneurysm	7	9.1%	11	7.3%
Superior cerebellar artery aneurysm	1	1.3%	3	2%
inferior cerebellar artery aneurysm			4	2.6%
Multiple aneurysms			10	6.6%

The most common type of aneurysm was saccular aneurysm (76.3) followed by fusiform aneurysm (10%), and 13.5 % had dissecting aneurysm. 95.1% of patients had spontaneous aneurysm formation, while 4.9% of patients had aneurysm due to infection (mycotic). The aneurysm in

67.2% patients measured less than 10 ml, while 21% measured from 10 to 25 ml, and in 11.8% measured 25 ml. There were 64.9% patients had narrow neck aneurysm, while 35.1% patients had wide neck aneurysms (**Table 5**).

Table (5): Description of type of aneurysm according to the Shape, Etiology, Size and Neck size.

Variables		Studied patients (N = 228)	Percent %
Shape of aneurysm	Saccular aneurysm (Berry aneurysm)	174	76.3 %
	Fusiform aneurysm	23	10.1%
	Dissecting aneurysm	31	13.5%
Etiology of aneurysm	Spontaneous	220	96.5%
	Mycotic	8	3.5%
Size of aneurysm	Less than 10 ml	153	67.1%
	From 10 to 25 ml	48	21.1%
	More than 25 ml	27	11.8%
Neck of aneurysm	Narrow	148	64.9%
	Wide	80	35.1 %

Complication occurred in 13 patients (3.4%). Aneurysmal rupture occurred in 2 patients (0.5%) and they were treated with insertion of another micro-catheter and use of balloon to allow hemostasis and complete impaction of aneurysm with coils, Clinically, the patients had no neurological deficit, Coil displacement occurred in 4 patients (1.1%) with usage of stent to allow coadaptation of coils

towards the wall, Hydrocephalus occurred in 1 patient (0.2%) and treated with V.P shunt, Vessel rupture occurred in 1 patient (0.2%). Vasospasm occurred in 6 patients (1.6%) who were treated by balloon dilation and medical treatment by rising the blood pressure where 4 of them had transient hemiparesis and the other 2 patients had permanent weakness (**Table 6**).

Table (6): Complication of endovascular techniques.

Complications	Patient (n = 13)	Percent 3.5%	Treatment
Aneurysmal rupture	2	0.5%	Insertion of another micro catheter and use of balloon
Coil displacement	4	1.1%	Stent assisted technique
Hydrocephalus	1	0.2%	V.P shunt
Vessel rupture	1	0.2 %	Parent artery occlusion
vasospasm	6	1.6%	Balloon dilation and medical treatment as rising blood pressure

DISCUSSION

Subarachnoid hemorrhage is a life threatening type of stroke that have a high mortality and morbidity and needs emergent interference to prevent the complication, this study is designed to assess the clinical presentation and the intervention manner of patient with SAH: As regard the gender of the candidates there were (53%) males and (47%) females. This agreed with study done by *chen et al. (2011)* that found 56.7% males and 43.3 females among the studied patients.

It disagrees with the study done by *Gunia et al. (2016)* in which the results of 80 patients 37 (46.25 %) men and 43 (53.75 %) women.

This can be explained that the male patients in Egypt had a higher ratio of smoking than the females making them more prone to have SAH as the percentage of smoking in male patient is 50.1% However the cases with aneurysmal rupture females are more common than male this may reflect the decrease in level of hormones may play a role in aneurysm rupture as most of females in this sub-group is menopause.

Regarding age, the mean age of the patients were 38 ± 9.4 ; while in study by *Kranthi et al. (2016)*, the age range of the candidates was 41-72 with mean of 51.3.

A 44.1% of the patients were known to be hypertensive, while 55.9 % were non hypertensive this percentage is more than the study done by *Fattahian et al. (2018)* where 84 (32.9%) were found to be hypertensive and less than the study done *Kranthi et al. (2016)* where 63.1% of cases were known to be hypertensive.

We also found that only 22.1% were diabetic and 44.2% were smoker and this percentage is less than *Fattahian et al. (2018)*, which found 17% diabetic among the candidates and 30% were smoker.

As regard clinical presentation, there were (48.6%) patients presented by headache, (21.4%) headache and associated symptom, (9.6%) patients presented by fits, the percentage of patient who developed D.C.L is (20.6%) and 23.5% developed weakness and seizure as (3.6%) patients presented by DCL and fits, (4.6%) patients presented by D.C.L and left side weakness, (6.4%) patients presented by D.C.L and Meningeal irritation signs and (5.9%) patients presented by D.C.L and Right side weakness.

This agreed with the study ran by *Kumar et al. (2010)* they found that 75 % the patients with a SAH complained of headache.

In this study 20.6% developed D.C.L and this percentage is less than the percentage of patient with DCL in the study done by *Kumar et al. (2010)* the most frequent presenting symptom in patients was a severe headache (75%) of abrupt onset (56%). Patients usually had temporary sensory or motor symptoms (54%). In a small group of patients, the presentation was more varied and included lethargy, fever, and confusion.

As regard anterior communicating aneurysm patients were 26.7%, MCA aneurysm were 18.4 %, posterior communicating aneurysm were 13.2%, para-ophthalmic artery aneurysm patients were 7%, basilar artery aneurysm were 7.9%, posterior inferior cerebellar artery aneurysm were 4.3%, supraclenoid carotid

artery aneurysm were 3%, peri callosal artery aneurysm were 3.5%, T carotid artery aneurysm patients were 7.9%, superior cerebellar artery aneurysm were 1.8%, inferior cerebellar artery aneurysms were 1.7%, and Multiple aneurysms were 4.3%.

In the study by *Kang et al. (2018)*, an analysis of 185 cases of aneurysmal SAH showed that the location of aneurysms was internal carotid artery in (32.5%), anterior communicating artery in (35.1%), middle cerebral artery in (20%), and posterior circulation in (12.4%). In the study ran by *Fattahian et al. (2018)* aneurysmal SAH patients, the location of aneurysms in 34.7% was anterior communicating artery, 33.4% in middle cerebral artery, 13.9% internal carotid artery, 9.7% in posterior fossa, and 8.3% in anterior cerebral artery.

Badry et al. (2014) found that the middle cerebral artery aneurysms (number = 10 aneurysms) were it the most common site followed by the anterior communicating artery aneurysms (number= 8 aneurysms), posterior cerebral arteries aneurysms (number =8 aneurysms), the internal carotid arteries and posterior communicating aneurysms (number= 4 aneurysms) for each and the ophthalmic artery aneurysms, anterior choroidal artery aneurysms and vertebrobasilar junction aneurysms (number =2 aneurysms) for each of them and finally basilar artery aneurysm (number =1 aneurysm)

As regard the size of aneurysm, there were 67.2% of patients have aneurysm measure less than 10 ml, while 21% of patients have aneurysm measure from 10 to 25 ml, and in 11.8% of patients have

aneurysm measure 25 ml. This agreed with the study done by *Ahmed et al. (2015)*.

As regard the shape of aneurysm, there were 76.3% patients have saccular aneurysm, while 13.5 % patients have dissecting aneurysm, and (10 %) patients had fusiform aneurysm.

In the study done by *Ahmed. et al. (2015)*, there were 29 (82.9%) patients of saccular shape, 2 (5.7%) patients of fusiform, shape and 4 (11.4%) patients of bilobed shape.

As regard the size of the neck there were (64.9%) patients had narrow neck aneurysm while (35.1%) patients had wide neck aneurysms this disagreed with the study done by *Ahmed et al. (2015)* as there were 17 (48.6%) patients of narrow neck (< 2 mm) and 18 (51.4%) patients of wide neck (> 2 mm).

As regard comparison between patients who are angiographically free versus with aneurysm; the ratio of male (62 %) patients and females (38%) patients in angiographically free patients and the reverse occurred in the other group which female patients were (52.6%) and males were (47.4%) with aneurysm and the noncontract enhanced the pattern of CT hemorrhage: it revealed in the angiographically free group that the premesencephalic cases were 70% and the non premesencephalic cases were 30 % while in the group with aneurysm the premesencephalic cases were 10.1% and the non premesencephalic cases were 89.9 %.

This disagreed with study done by *Coelho et al. (2016)* on 62 patient who had SAH with free endovascular

angiography results in which (46.8% - peri mesencephalic subarachnoid hemorrhage; 53.2% - non-peri mesencephalic subarachnoid hemorrhage) the ratio of male (44.8%) patients and females (54.5%).

The complications in studied patients who underwent the endovascular management were 3.4% in the form of aneurysmal rupture occurred in 0.5% of patients. Coil displacement occurred in 1.1% of patients, Hydrocephalus occurred in 0.2% of patients, Vessel rupture occurred in 0.2% of patients, and vasospasm occurred in 1.6% of patients. While in the study done in 2010 by Thieux that found the percentage of complications is 3.4% of patients with 2.1% groin hematoma and 1.3% cases with vasospasm *Hanak et al. (2012)*. And also, in the study done by *Ahmed et al. (2013)* in which they found complications were in the form of hemiparesis 10% (three cases; two of them were transient while one of them was permanent), hemiparesis is suggested to be due to vasospasm as a complication of SAH, Hydrocephalus occurred in three cases (10%) as a sequela of SAH for which a ventriculo-peritoneal (VP) shunt was applied.

CONCLUSION

- Cerebral catheter angiography is a safe, feasible and efficacious procedure.
- The new technique in the endovascular management of the cerebral aneurysm as balloon using, stent assisted technique and flow divertor stent is greatly reducing the complication rate and making the out come is very good comparable with previous years.

- The good choice of the line of treatment is markedly reducing the complication rate.
- Whenever the experience in endovascular management is increasing it will lead to good management of complication.
- Early intervention in the first few days of SAH before the period of vasospasm improving the outcome.

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التقييم الإكلينيكي وبالأشعة للمرضى الذين يعانون من نزيف تحت الأم العنكبوتية عن طريق تقنيه الطرح الرقمي بوحدة قسطره المخ التداخلية بمستشفى الحسين الجامعي

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خلفية البحث: يشير النزيف تحت الأم العنكبوتية إلى النزيف الذي يحدث بشكل أساسي داخل الفضاء تحت العنكبوتية ما بين حالات النزيف تحت العنكبوتية العفوية ويمثل تمزق تمدد الأوعية الدموية العفوي داخل الجمجمة حوالي 85 % من الحالات.

الهدف من البحث: تقييم العرض السريري وعوامل الخطر ومسببات النزيف تحت الأم العنكبوتية في عينة من المرضى المصريين، وكذلك تقييم نتائج القسطرة التداخلية والمضاعفات نتيجة التدخل بالقسطرة.

المرضى وطرق البحث: أجريت الدراسة على المرضى المصابين بنزيف تحت الأم العنكبوتية الذين تم علاجهم بالقسطرة التداخلية للمخ بمستشفى الحسين الجامعي، بما في ذلك المرضى الذين يعانون من النزيف تحت الأم العنكبوتية بأثر رجعي من 2006 إلى 2018، والمرضى الذين تم تشخيصهم حديثاً خلال عام 2019.

نتائج البحث: خلال الفترة من مايو 2006 إلى مايو 2017، تم قبول 560 مريض يعانون من النزيف تحت الأم العنكبوتية وقد استبعد 136 مريض (24.2%) من الدراسة لأنهم كانوا في حالة مرضية خطيرة، وكان مستوي تقييمهم عن طريق هس وهانت من 4 إلى 5، كما تم استبعاد 51 حاله أخرى بسبب الملفات المفقودة أو خرجوا من المستشفى دون اذن طبي. وقد بلغ عدد المرضى الباقين 373 والذين تم علاجهم بالقسطرة التداخلية للمخ بمستشفى الحسين الجامعي والمرضى الذين كانت نتيجة القسطرة التداخلية سالبه بلغ عددهم 145 مريضاً، المرضى ذوي تمدد الأوعية الدموية كانوا 228 مريضاً، وتوفي 77 مريضاً قبل العلاج بالقسطرة التداخلية بسبب تأخرهم بسبب مشاكل مالية، وكان عدد المرضى

الباقيين 151 وقد كان النوع الأكثر شيوعاً من تمدد الأوعية الدموية بين هؤلاء المرضى هو تمدد الشريان الأمامي التواصلي (27.8 %) ، ثم تمدد الشريان المخي الاوسط (17.8%) ، ثم تمدد الشريان التواصلي الخلفي (13.9%) ، ثم تمدد الشريان البصري (6.6%) ، ثم تمدد الشريان القاعدي (5.9%) ثم تمدد الشريان السفلي الخلفي المخيخي (6.4%) ، ثم تمدد الشريان السباتي (3.1%) ، ثم تمدد الشريان الكالوتي (3.3%) ، ثم تمدد الشريان السباتي (7.2%) ، ثم تمدد الشريان المخيخي الاعلي (1.9%) ، ثم تمدد الشريان المخيخي الأسفل (2.6%) ، ثم تمدد متعدد (6.6%) وقد قعت مضاعفات العلاج داخل الأوعية الدموية في المرضى الذين شملتهم الدراسة 13 مريضاً 3.4% في شكل تمزق تمدد الأوعية الدموية ، وضياع الملف و استسقاء الرأس وتمزق الشريان.

الاستنتاج: تصوير الأوعية القسطرة الدماغية هو إجراء آمن وفعال، والتقنية الجديدة في التدبير الوعائي للأوعية الدموية الدماغية كتقنية البالون أو تقنية مدعومة بالدعامات والدعامة المحولة تقلل إلى حد كبير من معدل المضاعفات وتجعل النتيجة جيدة للغاية.