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Aneurysms and Intracranial Hemorrhage in Iraqi Patients, A Cross-Sectional Study

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Abstract: Background: Cerebral aneurysms are abnormal dilations of the intracranial arteries that form as a result of a weakening of a segment of the wall of the artery. Objective: Our study aimed to assess the clinical outcomes of patients who have aneurysms and intracranial hemorrhage. Patients and methods: 92 patients with aneurysmal subarachnoid haemorrhage (SAH) were recruited. All patients, aged between 40 and 65 years, underwent microsurgical clipping, and the study period was from March 14, 2022, to August 9, 2023. This study recorded data and clinical, surgical, and diagnostic characteristics by classifying the severity of subarachnoid haemorrhage in patients as well as pain, complications, quality of care, and quality of life scores were also recorded. Results: The current results shown that males had microsurgical clipping procedures with 56 cases more than females with 36 cases, aneurysm size (mm), 6.4 ± 0.3, the most aneurysm location was an anterior communicating artery, which includes 31.52% of cases, clipping operation time was 5.7 ± 0.6, hospitalization time 6.22 ± 1.03 days, ICU admission included 6 cases, papaverine/nicardipine, % had 6 cases, angioplasties (%) had 7 cases, 3-month mortality (%) got 4 cases, post-operative complications was 13.04% of cases, where the most complication was vasospasm with 5 cases and infection with 3 cases, general health of good recovery for patients included 90.22% of cases. Conclusion: Our results show that microsurgical clipping shows significant improvements and high efficacy in treating patients with aneurysms and intracranial hemorrhage, which provides durable protection in preventing re-rupture of the aneurysm and intracranial hemorrhage.

Keywords: Subarachnoid hemorrhage; Aneurysms; Intracranial hemorrhage; Complications; Hunt and Hess scale; Microsurgical clipping procedure; and Quality of life.

INTRODUCTION

Cerebral aneurysms are abnormal dilatations of intracranial arteries that form because of weakening in a segment of their walls. They have a saccular or fusiform shape and may or may not generate symptoms regarding their status as broken or not broken. Most unruptured aneurysms are asymptomatic (Brisman, J. L. *et al.*, 2005; Im, S. H. *et al.*, 2009; Li, M. H. *et al.*, 2006; Nguyen, T. N. *et al.*, 2008).

The aneurysmal rupture, in general, causes a subarachnoid hemorrhage (SAH) that, according to its severity and complications, can cause different degrees of disability and even the death of the patient; it is estimated at 25% within the first 24 hours and up to 45% within the first month after bleeding (Schuette, A. J. *et al.*, 2011; Santillan, A. *et al.*, 2012; Mitchell, P. J. *et al.*, 2013). HSA is a type of cerebrovascular disease that remains the second cause of death and permanent disability in survivors in the world; in Ecuador, cerebrovascular disease occupies the first cause of death with a constant pattern in the last 25 years (Zhang, Y. *et al.*, 2013; Stapleton, C. J. *et al.*, 2015; Komotar, R. J. *et al.*, 2008). There are risk factors for growth and rupture of aneurysms, depending on the individual and others of the same aneurysm; in relation to the former: age, female sex, smoking status, arterial hypertension for the latter: size, location, neck-dome ratio, among others (Thompson, B. G. *et al.*, 2015; Steiner, T. *et al.*, 2013).

For the formation of aneurysms, genetic and environmental factors are also considered; among the former, those people with relatives in the first degree of consanguinity with cerebral aneurysms have a higher risk of having one than the general population (Raabe, A. *et al.*, 2002; Greving, J. P. *et al.*, 2009). The timely detection and treatment of cerebral aneurysms would prevent their rupture, decreasing mortality, sequelae, hospitalization expenses, and long-term therapies (Brown, R. D. Jr. & Broderick, J. P. 2014). The development of endovascular treatment techniques has revolutionized the management of this type of vascular abnormalities with the permanent tendency to be less invasive in their diagnosis and treatment (Hunt, W. E. & Hess, R. M. 1968; Frontera, J. A. *et al.*, 2006).

PATIENTS AND METHODS

This article conducted a cross-sectional study of patients suffering from aneurysms and intracranial hemorrhage, which included 92 patients whose ages ranged between 40-65 years. We collected clinical and surgical data for patients from different hospitals in Iraq from March 14, 2022, to

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August 9, 2023. Demographic data included age, sex, smoking, comorbidities, and body mass index. We excluded patients who were more than 65 years old and less than 40 years old, patients who had previous serious diseases, and those who had a body mass index of less than 20 kg per meter, while we included patients who had undergone previous surgeries, patients between the ages of 40 and 65 years, and patients who had diseases of both: high blood pressure, diabetes, heart failure, asthma, and kidney disease.

All patients underwent single-photon emission computed tomography every two to three days. The diagnosis of vasospasm was made through a clinical examination, which determined the extent of vasospasm, which was classified into mild, moderate, and severe. It also determined the size of the aneurysm (mm), identified the symptoms of vasospasm, and recorded the location of the aneurysm, which classified the degree of severity of subarachnoid hemorrhage (SAH) and the outcome. For bleeding in the space surrounding the brain, the scale ranges from 0 to 5, where 0 represents an unruptured aneurysm, and 5 represents the occurrence of coma or death. The Fisher score is determined in terms of small size and large size.

All patients underwent microsurgical resection surgery under general anesthesia, which included 92 patients. The patient management dealt with the cerebrovascular service through doctors with extensive experience in performing and managing patients under general anesthesia. Some patients were admitted to the intensive care unit and were treated with before a neurosurgeon and a neurologist. Furthermore, angioplasty or nicardipine/papaverine injections were performed for patients with severe vasospasm. Also, a vascular examination was performed after discharge using a computed tomography scan within a month or three months from the time of discharge from the hospital. For surgical data, the following data were recorded which included time to microsurgical resection, hospitalization time, intraoperative bleeding, ICU stay, mortality, angioplasty, papaverine/nicardipine, and 3-month mean modified Rankin scale.

Regarding post-operative data, complications after surgery were determined, pain rates were evaluated, and the Glasgow Outcome Scale (GOS) which evaluates the level of impact on the brain. And this scale ranges from 1 to 5, as this scale is classified according to the following criteria: 1 represents the occurrence of death, 2 represents the condition of persistent vegetative growth, 3 represents a severe disability, 4 represents a moderate degree of disability, and 5 represents a good recovery degree.

RESULTS

Table 1: Enrol demographic and preoperative characteristics of patients.

Characteristics	Details [n = 92]	Percentage %
Age, (mean ± SD)	52.6 ± 13.1	
Sex		
Male	56	60.87%
Female	36	39.13%
BMI, Kg		
< 24.7	14	15.22%
24.7 – 30.6	38	41.30%
> 30.6	40	43.48%
Smoking status		
Yes	34	36.96%
No	58	63.04%
Comorbidities		
Yes	63	68.48%
No	29	31.52%
1	34	36.96%
2	40	43.48%
3	57	61.96%
> 3	50	54.35%
Number of illnesses: Hypertension, Diabetes, Heart failure, Asthma, and kidney diseases.		

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Table 2: Diagnostics findings

Variables	Number of cases [n = 92]	Percentage %
Aneurysm size (mm), mean ± SD	6.4 ± 0.3	
Symptoms		
Sudden and severe headaches	28	30.43%
Loss of consciousness	20	21.74%
Nausea and vomiting	12	13.04%
Blurred or double vision	11	11.96%
Seizures	16	17.39%
Weakness on one side of the body	10	10.87%
Prior surgeries		
Yes	36	39.13%
No	56	60.87%
Family history of aneurysms		
Yes	30	32.61%
No	62	67.39%
Atherosclerosis		
Yes	62	67.39%
No	30	32.61%
Aneurysm location		
Anterior communicating artery	29	31.52%
Vertebrobasilar system	16	17.39%
Internal carotid artery	14	15.22%
Middle cerebral artery	19	20.65%
Posterior communicating artery	14	15.22%
Hunt and Hess scale		
1	4	4.35%
2	60	65.22%
3	14	15.22%
4	12	13.04%
5	2	2.17%
Modified Fisher grade		
Small volume (grade 1)	67	72.83%
Large volume (grades 2–4)	25	27.17%

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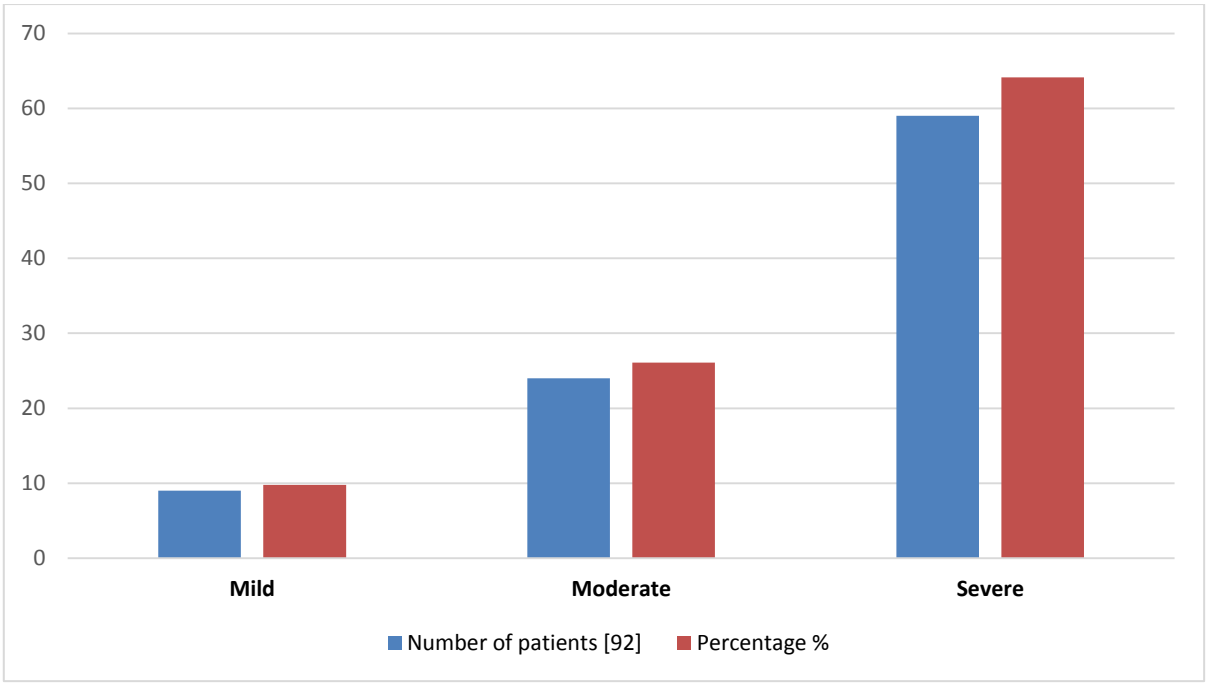

Figure 1: Classify the severity of impact aneurysms and intracranial hemorrhage on patients in terms of mild, moderate, and severe.

Table 3: Intraoperative results

Variables	Number of cases [N = 92]	Percentage %
Clipping operation time, mean ± SD	5.7 ± 0.6	
Hospitalization time (day), mean ± SD	6.22 ± 1.03	
General anesthesia	92	100%
Hemorrhage	3	3.26%
ICU admission, N [%]		
Yes	6	6.52%
No	86	93.48%
ICU stay, days, mean ± SD	11.43 ± 2.67	
Papaverine/nicardipine, %	6	6.52%
Angioplasties (%)	7	7.61%
In-hospital mortality (%)		
3-month mortality (%)	7	7.61%
Average 3-months modified Rankin Scale	3	3.26%

Table 4: Postoperative complications

Variables	Number of patients [n = 92%]	Percentage %
Vasospasm	5	5.43%
Infection	3	3.26%
Hydrocephalus	0	0.0%
Rebleeding	1	1.09%
Stroke	2	2.17%
Cognitive deficits	1	1.09%
Total	**12**	**13.04%**

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Table 5: Assessment levels of pain for patients with aneurysms and intracranial hemorrhage after clipping operation.

Pain levels	After Clip procedure	
	No. of patients	Percentage %
10 – 8	5	5.43%
7 – 5	6	6.52%
4 – 2	24	26.09%
< 2	57	61.96%

Table 6: Assessment of general health of patients with aneurysms and intracranial hemorrhage after clipping operation by Glasgow Outcome Scale (GOS)

GOS items	No. of patients	Percentage %
Severe disability	3	3.26%
Moderate disability	6	6.52%
Good recovery	83	90.22%

Table 7: Determine univariate analysis of risk factors related to patients with aneurysms and subarachnoid hemorrhage

	Univariate analysis	
Variables	Odds Ratio	95% CI
Age [above 50 years]	1.5	0.6 – 2.7
Sex	2.4	1.03 – 5.72
Comorbidities	1.1	0.5 – 1.8
Smoking	0.8	0.05 – 2.10
Atherosclerosis	3.2	1.4 – 3.9
Family history of aneurysms	2.8	2.2 – 3.4
Size >1 cm	3.0	1.6 – 5.8
Intracerebral hemorrhage	3.1	2.5 – 6.6
ICU admission	2.6	1.4 – 3.9
Aneurysm location	0.7	0.3 – 2.8
Vasospasm	2.4	1.7 – 5.2

DISCUSSION

In 2013, Longstreth *et al.*, conducted research who examined the consequences of subarachnoid hemorrhage (SAH) at King County (Van Swieten, J. C. *et al.*, 1988), Washington. The study was based on data from the population of the county. The study revealed a 70% survival rate at one month post hemorrhage and a 62% survival rate at one year. One month after the bleed, almost one-third of the patients had passed away, one-third had neurological impairments, and one-third were in good condition (mRS, 0-2) (Elijovich, L. *et al.*, 2008). Within our study, the proportion of patients who had death or disability (mRS, 3-6) after three months was only 10% among those with ruptured aneurysms. This is in stark with previous results, which indicated that 70% for patients had either been crippled or died (Cloft, H. J. & Kallmes, D. F. 2002; Sluzewski, M. *et al.*, 2001).

In a study conducted by Le Roux *et al*. in 2015, it was shown that 86 percent of individuals having HH grades I to III regained their ability to function independently after three months, with a modified Rankin Scale (mRS) score of 2 or better [23,24]. Out of the patients who had a grade IV or V at admission, 38% (54% of the patients with grade IV as well as 24% of those with grade V) improved to a satisfactory state at the 6-month follow-up (measured by mRS, 0-2). Within this series, 90% of the people with HH grade I and II, sixty-five percent in patients who HH grade III, 57% in patients with HH grade IV, along with 35% for patients with HH grade V saw recovery to a modified Rankin Scale (mRS) scoring of 0 to 2 at the 3-month mark (Pierot, L. *et al.*, 2011; Sluzewski, M., 2006; Levy, E. *et al.*, 2001). Therefore, the prognosis for people with aneurysmal subarachnoid hemorrhage (SAH) has been significantly improved through the past ten years. This might be attributed to developments in microsurgery approaches, the use of coiling in suitable patients, and the proactive management of vasospasms. The outcomes of a grade IV subarachnoid hemorrhage (SAH) by Hunt and

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Hess were similar to the outcomes of a grade III SAH according to Hunt and Hess scale. In individuals aged over 60 years old who meet criteria pointing at a bad prognosis following three months' time from the diagnosis date regarding SAH caused by grade V under the HH grading system, there is a very high risk of death or disability 91.7%. For future outcomes analyses in studies in patients with poor grades, each individual HH grade should be studied apart from others but not by merging groups. It is important to note specifically that we should treat high HH grade IV and HH grade V patients as separate groups (Pierot, L. *et al.*, 2009).

Attributing the clipping mortality and improved consequences to the pretreatment factors is admission grade inequality. These topics should be explored further with longer periods of observation and better result measurement methods, especially in terms of cognitive effects. In people undergoing neurosurgical operations for ruptured intracranial aneurysms, vasospasm tends to be less common. The same result was found in other studies where clipping was used. This means that cerebral vasospasm contributes more to death and disability as compared to brain surgery (Pierot, L. *et al.*, 2012).

In our study, the clipping operation resulted in significantly lower TCD-identified vasospasm than any other operation. The severity of vasospasm is proportionate to the volume of blood in sub-arachnoid spaced (it has a hypertonic effect), how well blood is removed during surgery (it is beneficial), and the method of handling vessels during surgery (it is damaging).

CONCLUSION

The results of our study indicate microsurgical clipping plays an essential part in the treatment of patients suffering aneurysms and cerebral bleeding through successfully preventing the life-threatening implications that can arise during an aneurysm rupture, where selection of this approach should be determined individually, noting the distinct attributes of each aneurysm, the individual's overall health, including the proficiency in the medical team conducting the operation.

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