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Cerebral Aneurysm Treatment in Limited Resources Situation

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ABSTRACT

Aim of the work: There is an increased number of patients suffering from cerebral aneurysm and a lack of data concerning the limited resource situation. The aim of this study was to evaluate a proposed policy for limited recourse situations affecting decision-making in aneurysm treatment

Patients and Methods: Over a two-year period, 62 patients with intracranial aneurysms underwent endovascular treatment or craniotomy and clipping at Al-Azhar University hospital and Mansoura International hospital. Patients underwent open craniotomy and clipping or endovascular treatment in correlation with clinical improvement. We studied the effect of recourse limitation on the outcome. Explanation of the current study's recourse limitation: 1-personal, 2-supplies, 3-adminstration, 4- equipment, 5-logistics.

Result: The participants in this study were 62 patients with cerebral aneurysms. We discovered that the age group in this study is between 40 and 70 years old, and that there is a correlation between age and outcome. There was no statistically significant relation between the type of surgery and the treatment outcome. Furthermore, the limited resources settings have an impact on treatment strategy, with clipping situations outperforming coiling cases.

Conclusion: In some limited resources settings, clipping is more practical than coiling. The proposed policy is associated with reasonable outcome and could be applied to all limited resources crises.

Keywords: *Cerebral Aneurysm; Resources Situation; Treatment.*

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INTRODUCTION

The frequency of intracranial aneurysms in the population in 2 to 5% of the population, the percentage of cerebral aneurysms is highest during the fourth, fifth, and sixth decades of life. [1]

The goal of surgical treatment of intracranial aneurysms is to isolate the aneurysm from the circulation, while preserving the normal blood flow through parent artery and branch vessels. Surgical treatment is best performed in a microsurgical operation, where places a clip across the aneurysm neck. This was first done by W. Dandy in 1938 but only in 1960s, after the introduction of operation microscope and improved neuro-intensive care, the results of surgery for aneurysms reached an acceptable level of morbidity and mortality.[2]

Endovascular techniques were first used for aneurysms that were considered inoperable or in patients whose previous surgical treatment had failed. In 1991, Guglielmi and his co-workers introduced an electrically detachable coil system (GDC), which started the endovascular treatment era of ruptured intracranial aneurysms. Standard coil embolization techniques have developed further since GDCs and other detachable platinium coils. For example, soft coils, 2D and 3D shaped coils, liquid embolic materials, and endovascular stents have been introduced. Embolization with coils has recently been used increasingly for the treatment of intracranial aneurysms. [3]

The aim of this study was to evaluate a proposed policy for limited recourse situations affecting decision-making in aneurysm treatment.

PATIENTS AND METHODS

This prospective study included 62 patients with intracranial aneurysms. They were admitted to the Neurosurgery Department, Alhussin Al-Azhar University Hospital, and Mansura International Hospital. The study protocol is approved by the Local Ethics Committee and written informed consent is obtained.

Two operative techniques were used: craniotomy and clipping and endovascular embolization.

The proposed policy stated that:

The endovascular technique was the first choice for all patients exept:

Those with aneurysms that may need stenting with one of the following characters:

Ruptured aneurysms those who may need surgery for hydrocephalus or hematoma evacuation those refusing endovascular surgery pregnancy, contrast hypersensitivity.

Clipping is the treatment of choice in the excluded cases in the previous point.

In limited resources situation preventing application of the endovascular techniques in a timely manner, clipping is the second choice for ruptured aneurysms only.

Twelve patients who complied with the policy were operated on in Al-Hussein hospital, and the other fifty patients were operated on in Mansoura international hospital.

Endovascular technique was performed for patients with un-ruptured aneurysms, patients who did not need a stent with concurrent probability to need surgery as, non-pregnant patients.

Clipping was performed for patients with ruptured aneurysms, patients with aneurysms needing stents with concomitant hydrocephalus or hematoma needing surgery, patients refusing endovascular operation, pregnant women, and contrast hypersensitivity patients.

Following an explanation of the benefits and the study protocol to all participants' families, a signed agreement was obtained from each participant's family.

The Neurovascular Unit was responsible for the care of all of the patients. Initial diagnosis information was obtained from the patient's family, including the patient's name, age, place of residence, the circumstances of the symptoms, and the patient's previous history of medical problems.

The neurological evaluation of each patient with NIHSS score was completed in its entirety (loc, horizontal eye movement, visual field defect, facial palsy, motor arm, motor leg, limb ataxia, sensory, language, speech extinction, and inattentio). CT Hunt and Hess grading, CT Fisher grading, and CT angio MRA and angio were also collected. A CTA was used to follow up on the clinical and radiographic findings.

RESULTS

Age	N	%
40 - 50Y	12	19.3
50–60Y	21	33.9
60-70 Y	29	46.7

Table 1: Distribution age of the patients according to age, most patients were aged between 60 and 70 years.

Age group	Good	Moderate	severe	Died
40-50	9 (69.2%)	3(23%)	1(7.6%)	0
50-60	15(78.9%)	3(15.7%)	1(5.2%)	0
60-70	15(50%)	0	5(16.6%)	10(33.3%)

p. value <0.05(p=.0.001,x2=12)

Table 2: Correlation between age group of the patients and outcome

When we studied the relation between age group of the patient's outcome we found there was significant relationship between age groups and outcome of treatment (P. value < 0.05) and show relation between age group and outcome mortality is more in age group above sixty, moderate and severe disability common in high age group.

Sex	Good	moderate	Severe	died
Male	19 (73%)	1(3.8%)	1(3.8%)	5(19.3%)
Female	20 (55.6%)	5(13.9 %)	6(16.7%)	5(13.9 %)

p. value >0.05(p=.0.126,x2=0.589)

Table 3: Correlation between the sex of patients and the outcome of management:

When we studied the relation between the sex of patients and the outcome there was non-significant relationship between sex groups and outcome of treatment and no relation between age group and mortality or disability (P. value > 0.05)(table 3).

Aneurysm diameter	Good	Moderate	Severe	Died
1-5mm	12 (70.5%)	2(11.7%)	1(5.8 %)	2(11.6%)
6-10mm	13 (61.9%)	3(14.2%)	2(9.5%)	4(19%)
11-20mm	14 (60.8%)	1 (4.3%)	4 (17.3%)	4(17.3%)

p. value >0.05(p=.0.886,x2=0.642)

Table 4: Correlation between aneurysm diameter and outcome of management

When we studied the relation between aneurysm diameter and outcome of management there was non-significant relationship between aneurysm diameter and outcome of treatment and no relation between aneurysm diameter and mortality or disability moderate or severe (P. value > 0.05) (table 4).

Hunt& Hess	<3	>3
NO	52	10
%	84	16%

Table 5: Hunt& Hess grade on admission. Regarding Hunt& Hess grade on admission most patients graded <3.

Hunt&Hess grading	Good	Moderate	Severe	Died
>3	0	0	0	10(100 %)
<3	39 (75%)	6(11.5%)	7(14.3%)	

P value <0.05(p=.0.001,x2=12)

Table 6: Correlation between Hunt& Hess grading of patients at time of surgery and outcome of management.

When we studied the relation between Hunt& Hess grading of patients at time of surgery and outcome of management there significant relationship between Hunt& Hess and outcome of treatment and there is relation between Hunt& Hess grading ,mortality and disability moderate or severe .patient with Hunt& Hess grading more than 3 show 100 % mortality (P < 0.05) (table 6).

Fisher grading	Good	Moderate	Severe	Died
>3	0	0	0	10(100%)
<3	39 (75%)	6(11.5%)	7(14.3%)	

p. value <0.05(p=.0.002,x2=10)

Table 7: correlation between Fisher grading and outcome of management

When we studied the relation between Fisher grading and outcome of management there significant relationship between Fisher grading on CT and outcome of treatment (P < 0.05) good function recovery and disability moderate or severe with patients fisher grading less than 3 and vice versa (table 7)

	good	Moderate	severe	Died
Fundus\neck>2	19 (70.3%)	2 (7.4%)	2(7.4%)	4(14.8%)
Fundus\neck<2	20(57.1%)	4(11.4%)	5(14.2%)	6(17.1%)

p. value >0.05(p=.0.126,x2=0.589)

Table 8: Correlation between Fundus/Neck ration and outcome of management

When we studied the relation between Fundus/Neck ration and outcome of management there was non-significant relationship between Fundus/Neck ration and outcome of treatment .There is no relation between Fundus/Neck ration and mortality or disability moderate or severe (P. value > 0.05)(table 8)

associated pathology	Good	Moderate	Severe	Died
No association	24(92.3%)	0	0	2(7.7)
ICH	8(61.5%)	2(15.3%)	1(7.6%)	2(15.3%)
IVH	8(47%)	2(11.7%)	3(17.6%)	4(23.5%)
HCP		2 (25%)	4 (50%)	2(25%)

p. value >0.05(p=.0.146,x2=0.7 89)

Table 9: Correlation between associated pathology and outcome of management

When we studied the relation between associated pathology and outcome of management there is non-significant relationship between other associated pathology and outcome of treatment. There is no relation associated pathology in mortality or disability moderate or severe (P > 0.05) (Table 9)

	Good	Moderate	Severe	Died
Clipping	27(54%)	6(12%)	7 (14%)	10(20%)
Coiling	12 (100%)		0	0

p. value >0.05(p=.0.129,x2=0.6 89)

Table 10: Correlation between the type of surgery and outcome of Management

When we studied the relation between the type of surgery and outcome of management there was non-significant relationship between type of surgery and outcome of treatment. There is no relation between type of surgery and mortality or disability moderate or severe. (P. value > 0.05) (Table 10)

site of aneurysm	Good	Moderate	Severe	Died
MCA	13 (56.5%)	1(4.3%)	5(21.7%)	4(17.3%)
Acom	12 (52.1%)	5(21.7%)	2(8.6%)	4(17.3%)
Pcom	4 (100%)	0	0	0
Pica	3 (100%)	0	0	0
ACA	3(75%)	0	0	1(25%)
ICA	4(80%)	0	0	1(20%)

P value >0.05(p=.0.136,x2=0.4 49)

Table 11: Correlation between site of aneurysm and outcome of management

When we studied the relation between site of aneurysm and outcome of management there was non-significant relationship site of aneurysm and outcome of treatment. There is no relation between site of aneurysm and mortality or disability severe moderate or (P. value > 0.05)(table 11).

	Good	Moderate	severe	Died
Coiling first choice	12(100%)	0	0	0
Clipping first choice	15 (48%)	6 (20%)	7(24%)	7(24%)
Clipping for resource limitation	12 (84%)	0	0	3 (14%)

P value =0.07

Table 12: Correlation between the type of surgery and outcome of Management

When we studied the relation between the type of surgery and outcome of management there was non-significant relationship between type of surgery and outcome of treatment. There is no relation between type of surgery and mortality or disability moderate or severe (P. value > 0.05) (table12).

	Complication during operation	Complication after operation
Coiling first choice	0	0
Clipping first choice	13(55%)	7(45%)
Clipping for resource limitation	0	4 (100%)

P value =0.06

Table 13: Correlation between the type of surgery and complication

When we studied the relation between the type of surgery and complication there was non-significant relationship between type of surgery and complication. There is no relation between type of complication and type of surgery (P. value > 0.05) (table13).

	Complete aneurysm occlusion	Incomplete aneurysm occlusion	Residual neck
Coiling first choice	12(100%)	0	0
Clipping first choice	28(80%)	7(20%)	0
Clipping for resource limitation	12(80%)	3(20%)	0

p value =0.08

Table 14: Correlation between the type of surgery and degree of aneurysm occlusion

When we studied the relation between the type of surgery and degree of aneurysm occlusion was non-significant relationship between type of surgery and degree of aneurysm occlusion. There is no relation between degree of aneurysm occlusion and type of surgery (P. value > 0.05) (table14).

DISCUSSION

In spite of more rapid diagnosis and aggressive neurosurgical intervention, the mortality rate of aneurysmal subarachnoid hemorrhage is still high. In our study, the overall mortality was 16% and the good functional recovery was 84%. This result came along with Frosen J, [4] who found the mortality rate in the majority of series ranging between 25% and 35% but another series found a mortality rate of 60%. [5]

In this study, it found a correlation between the age of the patients and the final outcome. Patients younger than 50 years showed a significantly higher rate of functional recovery and older patients (aged over 50) a higher mortality rate. This result came along with the result of Rabinstein et al., [6] who found increasing age is associated with a higher mortality from aneurysmal subarachnoid hemorrhage. They compared 33 young patients (aged 18–40 years) with old patients (aged over 65) and reported a significantly higher mortality rate in the older group than did Byrne JV, [7] who also reported a significantly higher mortality rate in the older patients.

The mechanism by which age has such an effect on outcome is unknown, but suggestions include a poor regenerative capacity of the older brain and a predisposition to develop a more lethal injury. [8]

In this study there was non-significant relationship between sex groups and outcome of treatment (P. value > 0.05).This result came along with the result et Lad SP et al., [9] who reported that the sex not related with functional recovery.[10] Also found that no difference in outcome result between male and female .

In this study aneurysm diameter and outcome of management there was non-significant relationship between aneurysm diameter and outcome of treatment (P. value > 0.05) and statistics insignificant.

In this study, the relation between Hunt & Hess grading of patients at time of surgery and outcome of management there significant relationship between Hunt & Hess and outcome of treatment (P < 0.05).This result came along t surgery <3 had favorable outcome .These result indicated that Hunt & H with [11] who reported that patients with Hunt & Hess grade were strong predictor for functional recovery and mortality of aneurysmal subarachnoid hemorrhage before surgery.

In this study we found significantly lower incidence of functional recovery (100%) mortality rate in the patients with NHISS score of <35 and NHISS statistics significant(p=0.000).This result came along with Anson JA et al., [12] who reported that there was a highly significant correlation between outcome and NHISS score at admission. Patients scoring NHISS > 35 at treatment have a mortality rate of 100% with favorable outcomes. Patients with NHISS<35 presented a mortality rate of 60 to 84% and favorable recoveries of 33 to 51%.

In this study, Fisher grading was significantly correlated with outcomes. The mortality in patients with 3 or greater midline shift was 93%, and this was compared with 0% for those patients with less than 3 (p = 0.000).

This result came along with Anson JA et al., [12] who reported the mortality in patients with 3 or greater was 53%, and this was compared with 25% for those patients with less than 3 Fisher grading. [13] were reported if Fisher grading was less than 3. Even in comatose patients, a benign course with clinical improvement after treatment may be present.

In this study, the fundus/neck ration was insignificantly correlated with outcomes (P value > 0.05). This result came along with [14], who found no statistical correlation between Fundus/Neck ration and outcome. Even cases that involve small fundus/neck rations may have poor outcomes and vice versa.

Anson JA et al. ([12]) reported that there is no significant correlation between outcome and fundus/neck ration.

Maud et al., 15 reported that in patients with aneurysmal subarachnoid hemorrhage a clear correlation between Fundus/Neck ration and outcome but Fundus/Neck ration not only predictor of outcome.

Mud et al., [16] also reported that the presence of large or small Fundus/Neck ration was a more important determinant of outcome coiling treatment than clipping.

In this study, patients who had not associated with brain contusions, HCP, IVH, ICH, HTN or cardiac deses achieved different functional recovery statistics insignificant (p=0.444).This result not came along with Diringer., [13] reported that mortality rate 91% in

aneurysmal SAH associated with HCP and 87% in associated with ICH and 53% in associated with HTN or cardiac deses. [13] also reported Patients with aneurysmal SAH with no association pathology or other dieses favorable prognostic factor. They suggested that the integral visceral membrane of the hematoma prevents diffusion of neurotoxic and vasoactive substances into the subarachnoid space, Patients who had associated pathology unfavorable outcomes.

Kataoka et al., [14] found that ICH in patients with aneurismal SAH leads to decreased cerebral blood flow increased damage and rapid development of brain swelling. Further, intra parenchyma hematomas may result in increased intracranial pressure and midline shift. These intracranial space-occupying lesions should be considered poor prognostic factors.

In this study only 14 cases, those who underwent coiling .had insignificantly lower incidence of functional recovery than those who underwent craniotomy and clipping But, we think these results do not indicate that craniotomy and clipping are better surgical modalities than coiling because there were significantly other factors affecting the choice of method of treatment, such as economy and surgeon preference. This result came along with Mud et al., [15] finding that the value of clipping more than coiling is still under debate. Molyneux AJ et al., [16] found no significant difference between the coiling group and the clipping group, but this finding may have been affected by differences in patient population economics and surgeon experiences.

In this study, patients who underwent clipping or coiling had no different outcome irrespective of the site of aneurysm. This does not suggest the site of aneurysm doesn't affect the outcome, but patients with the most severe clinical examination, who require emergent operations, are sent to the neurosurgical unit more rapidly for craniotomy and clipping than those with less severe clinical examination. The site of aneurysm may affect the method of treatment for post-circulatory aneurysm. Some surgeons prefer the coiling method of treatment. This result came along with Nichols et al., [17] who reported no difference in outcomes among the different sites of aneurysm patients operated with craniotomy and clipping or coiling. Sekhar et al., [18] discovered that the mortality rate in post-circulation aneurysms was higher than in ant-circulation aneurysms, and that craniotomy and clipping had better recovery rates than coiling, though this was not statistically significant. On the other hand, there was no difference in patients operated with craniotomy and clipping compared with those operated with a clipping series of 500 aneurysm patients.

In this study the group that was selected for clipping as first choice cases had poor result and more complication .This is explained by type of patient selection for clipping as first choice. Clipping was first choice in ruptured aneurysm, poor grading aneurysm as poor grading SAH, poor clinical condition, large intracranial aneurysm, intracerebral or intraventricular hemorrhage and hydrocephalus. In the group that was selected for coiling first choice or clipping for resources limitation cases had good result and less complication. This is explained by the type of patient selection. There is no need for stents or surgery as HCP or hematoma evacuation, the patient wants endovascular, the patient is not pregnant, and there is no hypersensitivity. This result came along with the results of Molyneux AJ et al., [16] who found poor grading anurism is correlated with a worse outcome.

In this study, the group that was selected for clipping as first choice was correlated with more incomplete aneurysm occlusion than coiling as first choice or clipping for recourses limitation. This is explained by the type of patient selection for clipping, as the first choice patient had an older age, increased aneurysm size, and complex morphology. This result came along with Nichols et al., [18] who reported that older age, increased aneurysm size, and complex morphology were correlated with more incomplete aneurysm occlusion.

LIMITATION

The number of cases isn't too large and there is limitation in recourses in application of endovascular treatment because it expensive and not available in all time. Limitation in training in endovascular technique makes clipping more feasible.

CONCLUSION

In a restricted resource setting, clipping is more practicable and has a lower cost of production than coiling. The proposed policy is associated with reseasnable outcome and could be applied to all limited resources crises.

Conflict of interest : none

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