Short term complications of early-mid phase microsurgical clipping of ruptured anterior cerebral circulation aneurysms

Section A-Research paper

Short term complications of early-mid phase microsurgical clipping of ruptured anterior cerebral circulation aneurysms

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Abstract

Background: Intracranial aneurysm rupture leads to aneurysmal subarachnoid hemorrhage (aSAH), which is a devastating condition with high morbidity and mortality.

Aim and objectives: The purpose of this study was to perform a comprehensive analysis of complications and outcomes in patients with ruptured anterior cerebral circulation aneurysms after early surgery.

Subjects and methods: This is a Cohort study which was conducted on 25 patients with anterior cerebral aneurysmal subarachnoid hemorrhage (aSAH) whom operated upon by microsurgical clipping within 10 days of SAH ictus at Neurosurgery Department, Faculty of Medicine Cairo University Hospitals, Egypt.

Results: there was a statistically significant difference between the studied groups regarding to worsening after 24 hs as same or improved male count is 10 with 90.0% while female count is 6 with 42.9% and worsen male count is 1 with 9.1% while female count is 8 with 57.1%. there was a statistically significant difference between the studied groups regarding to GCS on admission (same or improved mean is 14.19 and Standard Deviation is 1.68) and (worsen mean is 12.22 and Standard Deviation is 2.11) with P value equal 0.017.

Conclusion: The higher the grade of Hunt and Hess, Fisher and WFNS SAH the worse the outcomes of surgery. Early clipping was found to prefer as regard to patient outcome.

Keywords: AcoA aneurysm, anatomical, microsurgical strategies, clipping, coiling, surgical strategy

Introduction

Intracranial aneurysm rupture leads to (aSAH), which is a devastating condition with high morbidity and mortality. Early surgical or endovascular treatment for good-grade ruptured aneurysms has been widely adopted in most centers. **(1)**

Historically, poor-grade aneurysms are managed conservatively, and only patients who showed improvement are selected for surgery. Most patients without definitive treatment died because of aneurysm rebleeding and vasospasm.**(2)**

In the past decades, several studies have shown that early surgery improved the outcome in selected patients with poor-grade aneurysms. With advances in endovascular technology, endovascular treatment has been used as an available alternative to surgery for ruptured aneurysms. **(3)**.

Early and delayed treatment had equivalent clinical outcomes, without increased morbidity in the early group or increased risk of rebleeding in the delayed group. Larger aneurysm size of the ruptured or unruptured aneurysms, multiple unruptured aneurysms, and a fragile aneurysm sac as evidenced by intraoperative re-rupture of the ruptured aneurysm were factors favoring earlier treatment of "group 2" unruptured aneurysms. Patients with severe brain injury, cerebral edema, and decompressive craniectomy were treated in delayed fashion (>30 days), after they recovered from their ruptured aneurysm. **(4)**

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The purpose of this study was to perform a comprehensive analysis of complications and outcomes in patients with ruptured anterior cerebral circulation aneurysms after early surgery.

Subjects and Methods

The study was conducted on 25 patients with anterior cerebral aneurysmal subarachnoid hemorrhage (aSAH) whom operated upon by microsurgical clipping within 10 days of SAH ictus at Cairo university hospitals. Patients with anterior cerebral aneurysmal subarachnoid hemorrhage (aSAH) whom operated upon by microsurgical clipping within 10 days of SAH ictus.

Inclusion criteria: Any patient with anterior cerebral aneurysmal subarachnoid hemorrhage (aSAH) whom operated upon by microsurgical clipping within 10 days of SAH ictus of both sexes and at any age.

Exclusion criteria:

- Endovascularly treated patients.
- Microsurgical clipping after 10 days.
- Aneurysmal subarachnoid hemorrhage of posterior cerebral circulation origin.

A comprehensive analysis of complications and outcomes in patients with ruptured anterior cerebral circulation aneurysms after early surgery is recorded.

Sample size (number of study subjects included and justification including the clinical and statistical assumptions supporting sample size calculation)

Based on evidence from previous similar study and by considering the good outcome in patients with ruptured anterior cerebral circulation aneurysms after early surgery as a primary outcome. Epi-calc 2000 was used to calculate the sample size of this prospective clinical study. Assuming 80% power, 0.05 level of significance, 21% null hypothesis value and estimated proportion of 46%, Sample size will be = 23 participants. Considering drop-outs rate of 10%, therefore the final sample size will be **25 participants.**

Statistical analysis Microsoft excel 2013 was used for data entry and the statistical package for social science (SPSS version 21) was used for data analysis. Simple descriptive statistics (arithmetic mean and standard deviation) was used for summary of normal quantitative data (median and interquartile range) for summary of abnormal quantitative data and frequencies will be used for qualitative data. Bivariate relationship was displayed in cross tabulations and Comparison of proportions were performed using the chi-square and Fisher's exact tests where appropriate. T-independent was used to compare normally distributed quantitative data and Mann- Whitney for skewed data. P value was calculated to assess statistical significance, a value less than 0.05 will be considered statistically significant.

Results

Table (1) Demographic and comorbidities data among our study population

		Mean	Standard Deviation	Minimum	Maximum
Age		46.00	15.11	12.00	73.00
GCS on admission		13.48	2.04	9.00	15.00
GCS in 1st 24hs postoperative		13.08	2.33	9.00	15.00
days postictus at time of aneurysm clipping		6.28	3.41	1.00	10.00
		Count	%		
Sex	male	11	44.0%		
	female	14	56.0%		
Hypertension	present	8	32.0%		
	not present	17	68.0%		
other comorbidities	present	10	40.0%		
	not present	15	60.0%		

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The table showed that age mean is 46.00, Standard Deviation is 15.11, Minimum is 12.00, and Maximum is 73.00. GCS on admission mean is 13.48, Standard Deviation is 2.04, Minimum is 9.00 and Maximum is 15.00. GCS in 1st 24hs postoperative Mean is 13.08, Standard Deviation is 2.33, Minimum is 9.00 and Maximum is 15.00. Days postictus at time of aneurysm clipping mean is 6.28, Standard Deviation is 3.41, Minimum is 1.00 and Maximum is 10.00, male count is 11 with 44.0% and female count is 14 with 56.0%. Hypertension present count is 8 with 32.0%, not present count is 17 with 68.0%. Other comorbidities present count is 10 with 40.0%, not present count is 15 with 60.0%.

Table (2) grading systems among our study population

		Count	%
Hunt & Hess class	1	11	44.0%
	2	4	16.0%
	3	3	12.0%
	4	7	28.0%
Fisher Grade of SAH	1	8	32.0%
	2	3	12.0%
	3	10	40.0%
	4	4	16.0%
WFNS SAH grade	1	14	56.0%
	2	2	8.0%
	3	4	16.0%
	4	5	20.0%

The table showed that Hunt & Hess class 1 count is 11 with 44.0%, Hunt & Hess class 2 count is 4 with 16.0%, Hunt & Hess class 3 count is 3 with 12.0% and Hunt & Hess class 4 count is 7 with 28.0%. Fisher Grade of SAH 1 count is 8 with 32.0%, Fisher Grade of SAH 2 count is 3 is 10 with 40.0%, and Fisher Grade of SAH 4 count is 4 with 16.0%. WFNS SAH grade 1 count is 14 with 56.0%, WFNS SAH grade 2 count is 2 with 8.0%, WFNS SAH grade 3 count is 4 with 16.0% and WFNS SAH grade 4 count is 5 with 20.0%.

Table (3) outcome among our study population

		Count	%
urgent CSF diversion	done	4	16.0%
	not needed	21	84.0%
urgent hematoma evacuation	done	1	4.0%
	not needed	24	96.0%
complications in first 24 hours	yes	9	36.0%
	no	16	64.0%
worsening after 24 hs	same or improved	16	64.0%
	worsen	9	36.0%
edema & infarction	edema & infarction occurred	6	24.0%
	edema alone	3	12.0%
	infarction only	1	4.0%
	Neither edema nor infarction	15	60.0%
need for 2nd surgery	needed &done	3	12.0%
	not needed	22	88.0%
Discharged to	home &improved	12	48.0%
	rehabilitation center	6	24.0%
	died	7	28.0%
		Count	**%**
aneurysm clipping	**Early clipping**	8	32.0%
	Midphase clipping	17	68.0%

The table showed that urgent CSF diversion (done count is 4 with 16.0% and not needed count is 21 with 84.0%). Urgent hematoma evacuation (done count is 1 with 4.0% and not needed count is 24 with 96.0%). Complications in first 24 hours (yes count is 9 with 36.0% and no count is 16 with 64.0%). Worsening

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after 24 hs (same or improved count is 16 with 64.0% and worsen count is 9 with 36.0%). Edema & infarction (edema & infarction occurred count is 6 with 24.0%, edema alone count is 3 with 12.0% and infarction only count is 1 with 4.0%, neither edema nor infarction count is 15 with 60.0%). Need for 2nd surgery (needed &done count is 3 with 12.0% and not needed count is 22 with 88.0%). Discharged to (home &improved count is 12 with 48.0%, rehabilitation center count is 6 with 24.0% and died count is 7 with 28.0%), aneurysm clipping (Early clipping count is 8 with 32.0%, Midphase clipping count is 17 with 68.0%).

Table (4) Relations between time of clipping & outcome among our study population

		aneurysm clipping				
		Early clipping		Midphase clipping		P value
		Count	%	Count	%	
urgent CSF diversion	Done	0	0.0%	4	23.5%	0.269
	not needed	8	100.0%	13	76.5%	
urgent hematoma evacuation	Done	0	0.0%	1	5.9%	1
	not needed	8	100.0%	16	94.1%	
complications in first 24 hours	Yes	4	50.0%	5	29.4%	0.394
	No	4	50.0%	12	70.6%	
worsening after 24 hs	same or improved	6	75.0%	10	58.8%	0.661
	worsen	2	25.0%	7	41.2%	
edema & infarction	edema & infarction occurred	2	25.0%	4	23.5%	1
	edema alone	1	12.5%	2	11.8%	
	infarction only	0	0.0%	1	5.9%	
	Neither edema nor infarction	5	62.5%	10	58.8%	
need for 2nd surgery	needed &done	0	0.0%	3	17.6%	0.527
	not needed	8	100.0%	14	82.4%	
Discharged to	home &improved	5	62.5%	7	41.2%	0.653
	rehabilitation center	1	12.5%	5	29.4%	
	Died	2	25.0%	5	29.4%	

The table showed that there was no statistical significant difference between the studied groups regarding to urgent CSF diversion, urgent hematoma evacuation, complications in first 24 hours, worsening after 24 hs, edema & infarction, need for 2nd surgery and Discharged

Table (5) Relations between sex & outcome among our study population

		Sex				
		male		female		P value
		Count	%	Count	%	
urgent CSF diversion	Done	2	18.2%	2	14.3%	1
	not needed	9	81.8%	12	85.7%	
urgent hematoma evacuation	Done	0	0.0%	1	7.1%	1
	not needed	11	100.0%	13	92.9%	
complications in first 24 hours	Yes	3	27.3%	6	42.9%	0.677
	No	8	72.7%	8	57.1%	
worsening after 24 hs	same or improved	10	90.9%	6	42.9%	0.033
	worsen	1	9.1%	8	57.1%	
edema & infarction	edema & infarction occurred	1	9.1%	5	35.7%	0.324
	edema alone	2	18.2%	1	7.1%	
	infarction only	0	0.0%	1	7.1%	
	Neither edema nor infarction	8	72.7%	7	50.0%	
need for 2nd surgery	needed &done	1	9.1%	2	14.3%	1
	not needed	10	90.9%	12	85.7%	
Discharged to	home &improved	6	54.5%	6	42.9%	0.149
	rehabilitation center	4	36.4%	2	14.3%	

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Died	1	9.1%	6	42.9%	

The table showed that there was a statistically significant difference between the studied groups regarding to worsening after 24 hs as same or improved male count is 10 with 90.0% while female count is 6 with 42.9% and worsen male count is 1 with 9.1% while female count is 8 with 57.1% and P value equal 0.033. There was no statistical significant difference between the studied groups regarding to urgent CSF diversion, urgent hematoma evacuation, complications in first 24 hours, edema & infarction, need for 2nd surgery and Discharged.

Table (6) Relations between HTN & outcome among our study population

		Hypertension				
		present		not present		P value
		Count	%	Count	%	
urgent CSF diversion	Done	3	37.5%	1	5.9%	0.081
	not needed	5	62.5%	16	94.1%	
urgent hematoma evacuation	Done	0	0.0%	1	5.9%	1
	not needed	8	100.0%	16	94.1%	
complications in first 24 hours	Yes	2	25.0%	7	41.2%	0.661
	No	6	75.0%	10	58.8%	
worsening after 24 hs	same or improved	5	62.5%	11	64.7%	1
	worsen	3	37.5%	6	35.3%	
edema & infarction	edema & infarction occurred	3	37.5%	3	17.6%	0.272
	edema alone	2	25.0%	1	5.9%	
	infarction only	0	0.0%	1	5.9%	
	Neither edema nor infarction	3	37.5%	12	70.6%	
need for 2nd surgery	needed &done	0	0.0%	3	17.6%	0.527
	not needed	8	100.0%	14	82.4%	
Discharged to	home &improved	1	12.5%	11	64.7%	0.031
	rehabilitation center	4	50.0%	2	11.8%	
	Died	3	37.5%	4	23.5%	

The table showed that there was a statistically significant difference between the studied groups regarding to Discharged to (home &improved present count is 1 with 12.5% and not present count is 11 with 64.75, rehabilitation center present count is 4 with 50.0% and not present count is 2 with 11.8% and died present count is 3 with 37.5% and not present count is 4 with 23.0%. There was no statistical significant difference between the studied groups regarding to urgent CSF diversion, urgent hematoma evacuation, complications in first 24 hours, worsening after 24 hs, edema & infarction and need for 2nd surgery according to Hypertension among study population.

Table (7) Relation with age, GCS on admission according to worsening after 24 hs among our study population

	worsening after 24 hs				
	same or improved		worsen		P value
	Mean	Standard Deviation	Mean	Standard Deviation	
Age	46.37	11.48	45.33	20.89	0.893
GCS on admission	14.19	1.68	12.22	2.11	0.017

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The table showed that there was a statistically significant difference between the studied groups regarding to GCS on admission (same or improved mean is 14.19 and Standard Deviation is 1.68) and (worsen mean is 12.22 and Standard Deviation is 2.11) with P value equal 0.017. There was no statistical significant difference between the studied groups regarding to age, according to worsening after 24 hs among study population.

Table (8) Relation with age, GCS on admission according to Discharged to among our study population

	Discharged to						P value
	home &improved		rehabilitation center		died		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
Age	43.58	10.90	47.17	18.90	49.14	19.30	0.741
GCS on admission	14.42	1.44	13.00	2.76	12.29	1.70	0.066

The table showed that there was no statistical significant difference between the studied groups regarding to Age and GCS on admission according to Discharged to among study population.

Table (9) Relations between grades & outcome according to Hunt & Hess class among our study population

		Hunt & Hess class				P value
		grade 1&2		grade 3&4		
		Count	%	Count	%	
urgent CSF diversion	done	0	0.0%	4	40.0%	0.017
	not needed	15	100.0%	6	60.0%	
urgent hematoma evacuation	done	0	0.0%	1	10.0%	0.400
	not needed	15	100.0%	9	90.0%	
complications in first 24 hours	yes	4	26.7%	5	50.0%	0.397
	no	11	73.3%	5	50.0%	
worsening after 24 hs	same or improved	12	80.0%	4	40.0%	0.087
	worsen	3	20.0%	6	60.0%	
edema & infarction	edema & infarction occurred	2	13.3%	4	40.0%	0.011
	edema alone	0	0.0%	3	30.0%	
	infarction only	1	6.7%	0	0.0%	
	Neither edema nor infarction	12	80.0%	3	30.0%	
need for 2nd surgery	needed &done	1	6.7%	2	20.0%	0.543
	not needed	14	93.3%	8	80.0%	
Discharged to	home &improved	10	66.7%	2	20.0%	0.074
	rehabilitation center	3	20.0%	3	30.0%	
	died	2	13.3%	5	50.0%	

The table showed that there was a statistically significant difference between the studied groups regarding to urgent CSF diversion (done grade 1&2 count is 0 with 0.0%, grade 3&4 count is 4 with 40.0% and not needed grade 1&2 count is 15 with100.0%, grade 3&4 count is 6 with 60.0% and P value equal 0.017) and edema & infarction (edema & infarction occurred grade 1&2count is 2 with 13.3% and grade 3&4 count is 4 with 40.0%, edema alone grade 1&2 count is 0 with 0.0% and grade 3&4 count is 3 with 30.0%, infarction only grade 1&2 count is 1 with 6.7% and grade 3&4 count is 0 with 0.0% and Neither edema nor infarction grade 1&2 count is 12 with 80.0% and grade 3&4 count is 3 with 30.0%). there was no statistical significant difference between the studied groups regarding to urgent hematoma evacuation, complications in first 24 hours, worsening after 24 hs, need for 2nd surgery and Discharged to according to Hunt & Hess class among study population.

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**Table (10) Relations between grades & outcome according to Fisher Grade of SAH among our study population**

		Fisher Grade of SAH				
		grade 1&2		grade 3&4		P value
		Count	%	Count	%	
urgent CSF diversion	done	1	9.1%	3	21.4%	0.604
	not needed	10	90.9%	11	78.6%	
urgent hematoma evacuation	done	0	0.0%	1	7.1%	1
	not needed	11	100.0%	13	92.9%	
complications in first 24 hours	yes	2	18.2%	7	50.0%	0.208
	no	9	81.8%	7	50.0%	
worsening after 24 hs	same or improved	9	81.8%	7	50.0%	0.208
	worsen	2	18.2%	7	50.0%	
edema & infarction	edema & infarction occurred	1	9.1%	5	35.7%	0.074
	edema alone	0	0.0%	3	21.4%	
	infarction only	1	9.1%	0	0.0%	
	Neither edema nor infarction	9	81.8%	6	42.9%	
need for 2nd surgery	needed &done	1	9.1%	2	14.3%	1
	not needed	10	90.9%	12	85.7%	
Discharged to	home &improved	7	63.6%	5	35.7%	0.197
	rehabilitation center	3	27.3%	3	21.4%	
	died	1	9.1%	6	42.9%	

The table showed that there was no statistical significant difference between the studied groups regarding to urgent CSF diversion, urgent hematoma evacuation, complications in first 24 hours, worsening after 24 hs, edema & infarction, need for 2nd surgery and Discharged to according to Fisher Grade of SAH among study population.

Table (11) Relations between grades & outcome according to WFNS SAH grade among our study population

		WFNS SAH grade				
		grade 1&2		grade 3&4		P value
		Count	%	Count	%	
urgent CSF diversion	done	0	0.0%	4	44.4%	0.010
	not needed	16	100.0%	5	55.6%	
urgent hematoma evacuation	done	0	0.0%	1	11.1%	0.360
	not needed	16	100.0%	8	88.9%	
complications in first 24 hours	yes	4	25.0%	5	55.6%	0.200
	no	12	75.0%	4	44.4%	
worsening after 24 hs	same or improved	13	81.3%	3	33.3%	0.031
	worsen	3	18.8%	6	66.7%	
edema & infarction	edema & infarction occurred	2	12.5%	4	44.4%	0.122
	edema alone	1	6.3%	2	22.2%	
	infarction only	1	6.3%	0	0.0%	
	Neither edema nor infarction	12	75.0%	3	33.3%	
need for 2nd surgery	needed &done	1	6.3%	2	22.2%	0.530
	not needed	15	93.8%	7	77.8%	
Discharged to	home &improved	10	62.5%	2	22.2%	0.068
	rehabilitation center	4	25.0%	2	22.2%	
	died	2	12.5%	5	55.6%	

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The table showed that there was a statistically significant difference between the studied groups regarding to urgent CSF diversion (done grade 1&2 count is 0 with 0.0% and grade 3&4 count is 4 with 44.4%, Not needed grade 1&2 count is 16 with 100.0% and grade 3&4 count is 5 with 55.6% and P value equal 0.010) and worsening after 24 hs (same or improved grade 1&2 count 13 with 81.3% and grade 3&4 count is 3 with 33.3%, worsen grade 1&2 count is 3 with 18.8% and grade 3&4 count is 6 with 66.7%). there was no statistical significant difference between the studied groups regarding to urgent hematoma evacuation, complications in first 24 hours, edema & infarction, need for 2nd surgery and Discharged to according to WFNS SAH grade among study population.

Preoperative CT & angiography

Post operative CT & angiography
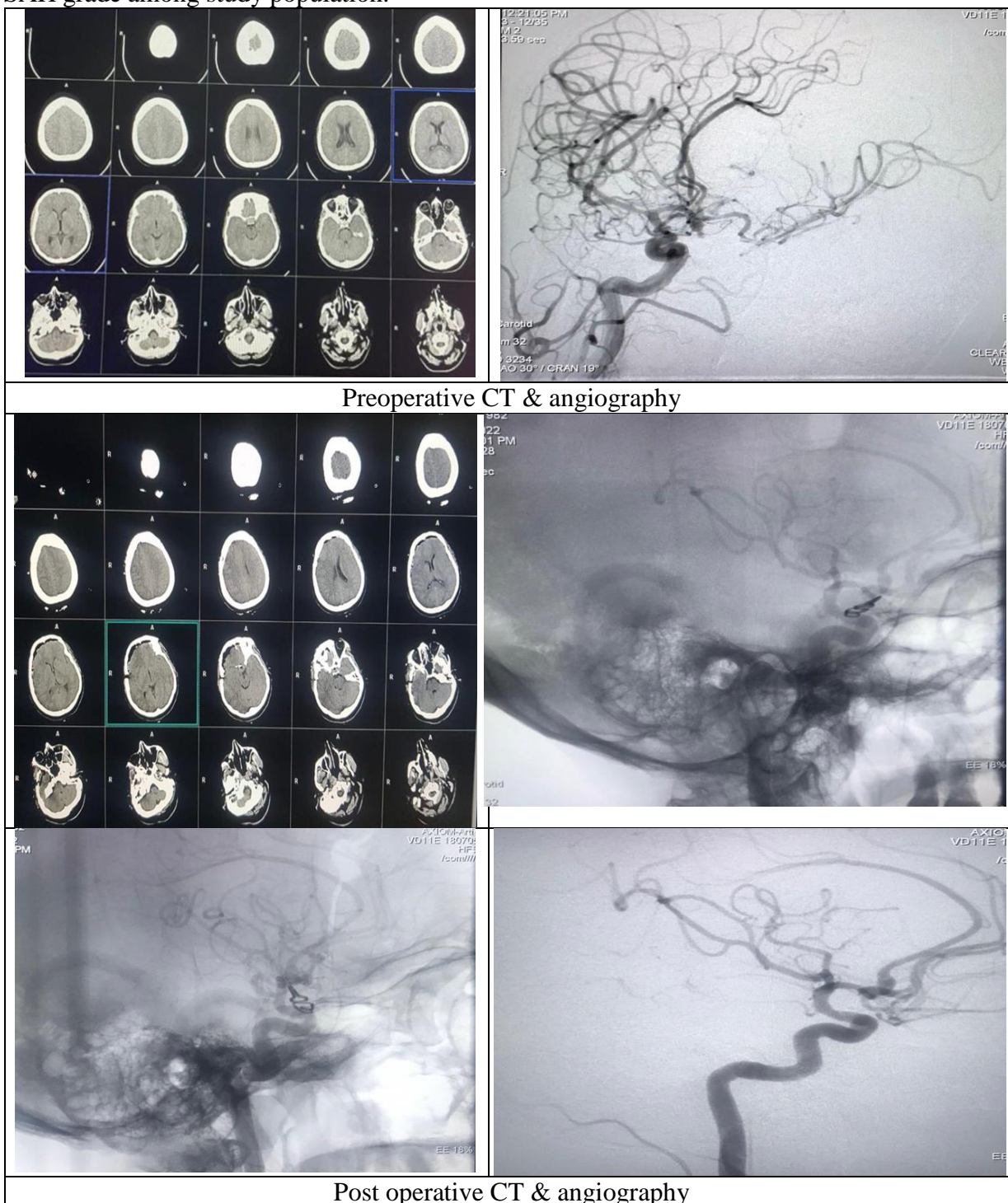
Figure 1: 47 years female, known hypertensive, with history of deterioration of vision in the last 6 months

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Presented by sudden severe headache, not suffered before, On examination: patient is Fully conscious (GCS15/15) , Full motor power, Ophthalmology examination: Rt eye 3/60, Lt eye HM Investigations: CT brain & cerebral angiography showed Rt anterior cerebral aneurysm (at junction of ACA & a-com) measuring 1.5*1.2 cm directed posteriorly, medially & inferiorly bulging in suprasellar cistern, Operated upon by clipping in 2nd day with no intraoperative or postoperative complications. Patient postoperative is fully conscious, FMP, vision same as preoperative, Patient discharge to home
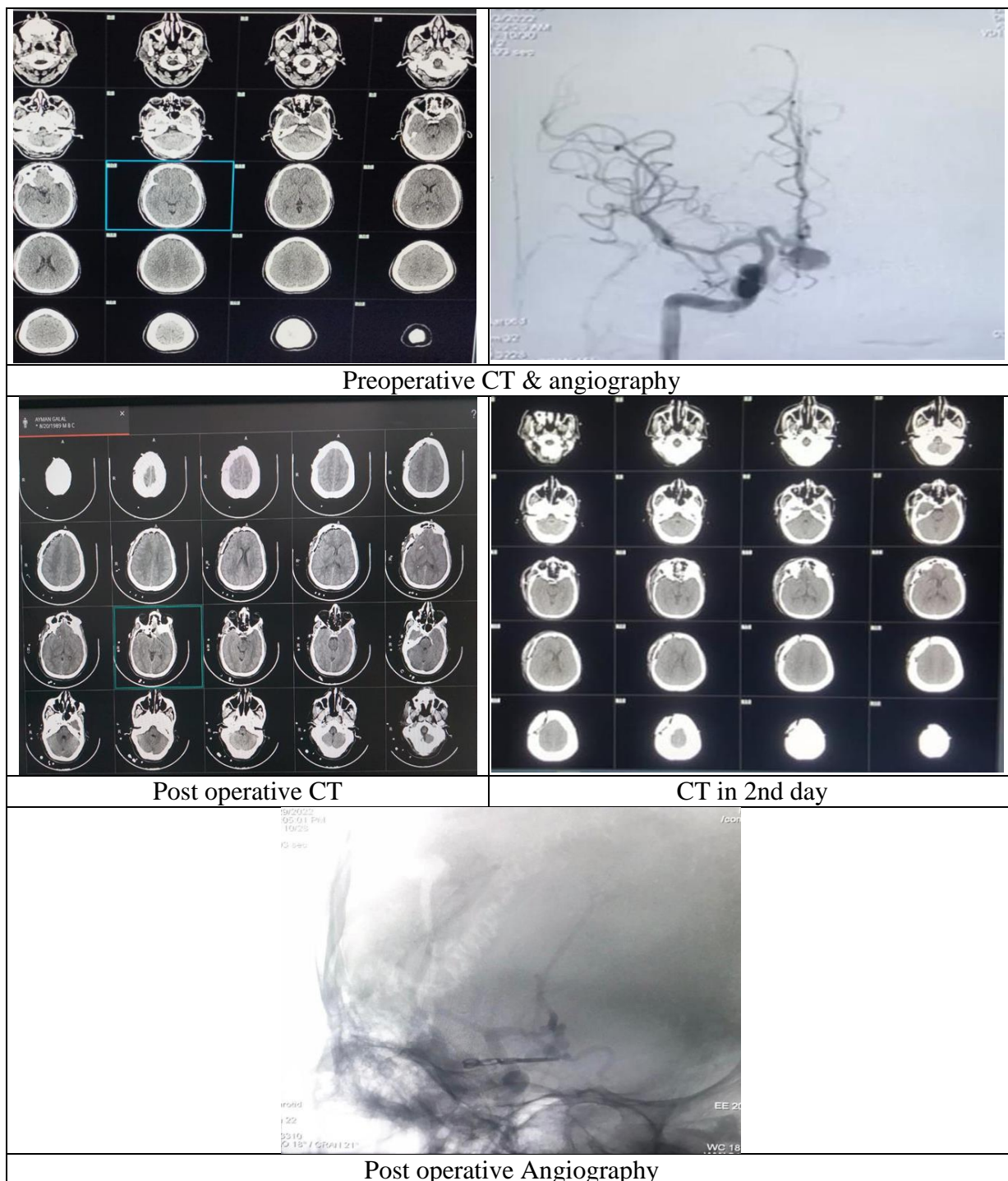
Preoperative CT & angiography

Post operative CT

CT in 2nd day

Post operative Angiography

Figure 2: 39 year old male, medically free, surgically free, History of diminution of vision in Left eye
Patient sought medical advice at ophthalmology clinic then referred to neurology department admitted for one month as optic neuritis for which plasmapheresis was done then patient developed sudden severe headache, for which neurosurgical consultantion was done CT brain and cerebral angiography done showed a-com aneurysm (at junction of RT ACA & a-com) measuring 1*0.9 cm directed downward and toward right side, left ACA hypoplastic, Visual acuity: Rt 6/9, Lt 6/60, Operated

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upon by clipping , Postoperative patient is obeying confused GCS 14/15, FMP, and vision as pre, 2nd day patient improved to be FC, FMP, Discharged to home.

Discussion

Intracranial aneurysm rupture leads to aneurysmal subarachnoid hemorrhage (aSAH), which is a devastating condition with high morbidity and mortality. Early surgical treatment for good-grade ruptured aneurysms has been widely adopted in most centers. **(5)**

Historically, poor-grade aneurysms are managed conservatively, and only patients who showed improvement are selected for surgery. Most patients without definitive treatment died because of aneurysm re-bleeding and vasospasm. **(6)** Early surgery has been proposed to improve outcomes of selected patients with poor-grade ruptured intracranial aneurysms. Early-mid phase surgery was defined as surgery performed within 3 days or 3-10 days after SAH ictus. **(7)**

A complication related to the surgical procedure was considered on a clinical basis when either a focal deficit (hemiparesis or cranial nerve palsy) or a deteriorated state of consciousness was noted within the first 24 hours after surgery and had been absent during the preoperative period. Patients' charts were reviewed to determine the existence of possible confounding factors that could have contributed to postoperative clinical deterioration such as the initial SAH ictus, vasospasm, hydrocephalus, and septic status. **[8]**

A surgical complication was declared responsible for the patient's postoperative deterioration when other postoperative complications could not account for new symptoms. **[9]** We classified surgical complications into four categories: 1) direct nerve tissue injuries such as brain tissue or cranial nerve injuries; 2) intracranial vascular complications; 3) surgical complications related to the craniotomy; and 4) other complications related to the surgical procedure that are not specified by the other categories. **[10]**

As regard to demographic data we found in our study that the age mean was 46.00, Standard Deviation was 15.11, Minimum was 12.00, and Maximum was 73.00. GCS on admission mean was 13.48, Standard Deviation was 2.04, Minimum was 9.00 and Maximum was 15.00. GCS in 1st 24hs postoperative Mean was 13.08, Standard Deviation was 2.33, Minimum was 9.00 and Maximum was 15.00. Days post ictus at time of aneurysm clipping mean was 6.28, Standard Deviation was 3.41, Minimum was 1.00 and Maximum was 10.00.

Our study was consistent with **Lehecka et al. (11)** who aimed to compare treatment outcomes of these lesions with intracranial aneurysms in general and to identify factors predicting the outcome. As regard to age as the mean age and range was 40 (4–59).

As regard to sex and comorbidities we noted in our study that that male count was 11 with 44.0% and female count was 14 with 56.0%. Hypertension present count was 8 with 32.0%, not present count was 17 with 68.0%. Other comorbidities present count was 10 with 40.0%, not present count was 15 with 60.0%.

Our study was consistent with **Choudhri et al. (12)** who aimed to study combined endovascular and microsurgical management of complex cerebral aneurysms as females were higher than male participants 20 Males (32%) 43 Females (68%).

Our study was in disagreement with **Lehecka et al. (11)** as regard to sex as male participants were higher than females Male 41 (60%) Female 27 (40%).

As regard to grading system among our study population we found that Hunt & Hess class 1 count was 11 with 44.0%, Hunt & Hess class 2 count was 4 with 16.0%, Hunt & Hess class 3 count was 3 with 12.0% and Hunt & Hess class 4 count was 7 with 28.0%. Fisher Grade of SAH 1 count was 8 with 32.0%, Fisher Grade of SAH 2 count was 3 12.0% and class 3 was 10 with 40.0%, and Fisher Grade of SAH 4 count was 4 with 16.0%. WFNS SAH grade 1 count was 14 with 56.0%, WFNS SAH grade 2 count was 2 with 8.0%, WFNS SAH grade 3 count was 4 with 16.0% and WFNS SAH grade 4 count was 5 with 20.0%.

In agreement with our study **Lehecka et al. (11)** found that as regard to Hunt and Hess score it was Hunt and Hess Grade I–II 44 (65%) Hunt and Hess Grade III–V 24 (35%).

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Our study was in disagreement with **zhao et al. (13)** who aimed to study Complications and outcomes after early surgical treatment for poor-grade ruptured intracranial aneurysms as Out of the 80 included patients, 41 (51%) presented with WFNS grade IV, and 39 (49%) with WFNS grade V.

Also our study was in disagreement with **Oishi et al. (10)** who aimed to study Feasibility and efficacy of endovascular therapy for ruptured distal cerebral artery aneurisms as the majority of cases according to Hunt & Hess score was grade II.

As regard to outcome among our study population we found that urgent CSF diversion (done count is 4 with 16.0% and not needed count is 21 with 84.0%). Urgent hematoma evacuation (done count is 1 with 4.0% and not needed count is 24 with 96.0%). Complications in first 24 hours (yes count is 9 with 36.0% and no count is 16 with 64.0%). Worsening after 24 hs (same or improved count is 16 with 64.0% and worsen count is 9 with 36.0%). Edema & infarction (edema & infarction occurred count is 6 with 24.0%, edema alone count is 3 with 12.0% and infarction only count is 1 with 4.0%, neither edema nor infarction count is 15 with 60.0%). Need for 2nd surgery (needed &done count is 3 with 12.0% and not needed count is 22 with 88.0%). Discharged to (home &improved count is 12 with 48.0%, rehabilitation center count is 6 with 24.0% and died count is 7 with 28.0%).

Our study was consistent with **Lehecka et al. (11)** as regard to One-year outcome for both actively and conservatively treated patients as the majority of patients had good recovery 159 (57%) while only 37 (13%) were dead.

Also, our study was consistent with **S˛ekerci et al. (14)** who aimed to study Aneurysms of the distal anterior cerebral artery as Nine cases resulted in good recovery (90%) and 1 case showed moderate disability (10%). That case had only postoperative morbidity (mild hemiparesis) related to vasospasm and she experienced complete resolution of symptoms after a year.

As well as, **Sekhar et al. (15)** who aimed to study microsurgical management of anterior communicating artery aneurysms as 3 (7.69%) of patients with surgical complications had infarction.

Our study was in disagreement with **Heit et al. (16)** who found that no patients had Ischemic frontal lobe infarction at presentation and 33 (71.7%) had any ischemic infarction after treatment with clipping.

As regard to time of aneurysm clipping among our study population we found that early clipping count is 8 with 32.0%, Midphase clipping count is 17 with 68.0%.

Chhabra et al. (17) found that Time interval between ictus and surgery in majority of patients was from 4-6 days which was in agreement with our study.

As regard to Relations between time of clipping & outcome among our study population we found that there was no statistical significant difference between the studied groups regarding to urgent CSF diversion, urgent hematoma evacuation, complications in first 24 hours, worsening after 24 hours, edema & infarction, need for 2nd surgery and Discharged to.

Our study was in consistent with **czepko et al. (18)** as there was no significant difference between early and late surgery. however intraoperative complications were higher in patients who undergone surgery in period of 4-21 days 3(50%).

Our study was consistent with **Lee et al. (19)** who aimed to study Surgery for distal anterior cerebral artery aneurysms as the results of surgical treatment for the 117 patients with DACA aneurysms were favorable in 94% (90.6% good and 3.4% fair) and unfavorable in 6% (5.1% poor and 0.9% dead). All unfavorable outcomes occurred in patients who were of preoperative grades 4 or 5.

Also, our study was consistent with **Mclaughlin et al. (20)** who found that number of patients without surgical complications was higher in grade I and II than in grade III and IV.

As regard to Relations between grades & outcome according to Fisher Grade of SAH among our study population we found that there was no statistical significant difference between the studied groups regarding to urgent CSF diversion, urgent hematoma evacuation, complications in first 24 hours, worsening after 24 hs, edema & infarction, need for 2nd surgery and Discharged to according to Fisher Grade of SAH among study population.

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Conclusion

The higher the grade of Hunt and Hess, Fisher and WFNS SAH the worse the outcomes of surgery. Early clipping was found to prefer as regard to patient outcome. Female patients were found to be at higher risk of developing worsening of complications after 24 hours of surgery.

Conflicts of Interest: The authors declare no conflict of interest.

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